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Diseases of Middle Life

THE PREVENTION, RECOGNITION AND TREATMENT OF
THE MORBID PROCESSES OF SPECIAL SIGNIFICANCE
IN THIS CRITICAL LIFE PERIOD

*COMPRISING TWENTY-TWO ORIGINAL ARTICLES
BY VARIOUS EMINENT AUTHORITIES*

EDITED BY

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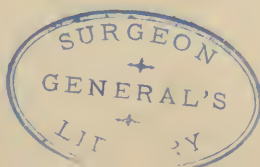
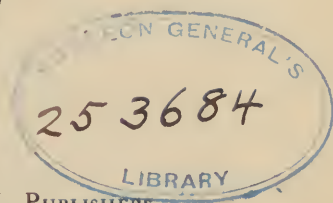
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The Gastric Disturbances of Middle Life

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The Gastric Disturbances of Middle Life.

FOREWORD.

THE gastric affections of middle life are worthy of the most careful consideration. It is only by means of a comprehensive study of these conditions that the various factors leading to the development of senile changes can be definitely determined, and much may be accomplished by the early recognition of such influences in the prevention and amelioration of these diseases, and in the prolongation of life.

It is in middle life when the most serious forms of gastric disturbances first begin to manifest themselves, frequently appearing with symptoms so mild and insignificant that their importance is completely overlooked until late in their course—often only after alarming signs have already developed.

Many of these disorders have their origin in youth, at that period often in an apparently unimportant form, while others drag along from youth to old age with exacerbations and remissions only presenting serious manifestations in middle life when the transition from benign to malignant states is so commonly observed.

Again attention must be directed to the fact that the incidence of nervous gastric affections is greater in the young while organic affections are more common in older individuals. One need only remember that in youth the tissues are resilient and less vulnerable to insults, so that ordinary influences make but little impression upon the gastric mucosa; whereas in older individuals in whom degenerative changes have already begun to manifest themselves, these same factors often bring about marked pathological changes.

On comparing the gastric disorders of youth and of middle life, one is at once impressed with the fact that the acute types are more frequently observed in the young, while the more chronic forms are more frequent in adults. This may

be due to the fact that the causative factors leading to the disease have not been sufficiently potent to as yet make serious inroads into the younger patient's health, until the influence has become so continuous as to produce organic manifestations. Finally it is always important to hold in mind that in order to make any advance in the amelioration and prevention of gastric disorders in middle life, all causative factors bearing upon the etiology of these affections must be taken into consideration and not until these are definitely recognized can we hope to make any material advance in the prevention and cure of these diseases.

ETIOLOGY.

The various factors concerned in the production of the gastric disorders of middle life may be grouped as follows:

Focal infections.

Infectious diseases.

Local degenerative changes.

Arteriosclerosis.

Toxemias.

Syphilis.

Influence of diseases of other organs (liver, heart, lungs, kidneys, nervous system, genito-urinary system).

Indiscretions in diet.

Disturbances of the nervous system.

Disturbances of the endocrine system.

Trauma.

FOCAL INFECTIONS.

It is a well established fact that focal infections may play an exceedingly important rôle in the production of certain gastric disorders of middle life. The primary foci may be localized in various portions of the body; as in the teeth, tonsils, sinuses, gall-bladder, appendix, intestine, genito-urinary tract or other organs.

There can be no question, for example, but that the cause of a certain proportion of ulcerations is a hematogenous infection with special strains of streptococci absorbed from certain foci of infection. Rosenow's work brought this out conclusively and has thus materially altered our views re-

garding the etiology of ulcer in these cases; and consequently it is now generally maintained that previous to instituting treatment all sources of focal infection should, as far as possible, be removed. According to this investigator, peptic ulcer may be produced experimentally in animals by the intravenous injection of certain strains of streptococci, and he has been able to isolate these strains from the ulcer base in man and has shown that they have an elective affinity for the stomach wall of animals when injected intravenously.

The method of production of the ulceration is an infection of an embolic streptococcic type in the submucous layers of the stomach with the production of hemorrhagic areas in the surrounding tissue; in consequence of which anemic necrosis takes place followed by the digestion of the mucous membrane above by the gastric secretion. Depending upon the extent of the infection, either healing may take place or chronic ulceration ensue.

INFECTIOUS DISEASES.

Beaumont first called attention to the fact that in febrile states there is a diminished secretion of gastric juice together with a lowered digestion of food. It is therefore not uncommon to observe symptoms of indigestion accompanying many of the infectious fevers occurring during middle life. The symptoms of dyspepsia are more pronounced in certain of these affections than in others, for example, one commonly finds gastric upsets in the form of nausea, vomiting and distention in typhoid fever, tuberculosis, influenza and pneumonia. In these infectious fevers the appetite is always diminished, and in many instances there is marked anorexia. The symptoms of indigestion may not only be present during the entire course of the fever, but may continue on during the stage of convalescence.

Gastritis may be produced both directly and indirectly by infections. Thus thrush due to the growth of schizomycetes may extend directly into the stomach, developing as a part of the general infection. Rosenheim has reported a case of this disease associated with violent gastric symptoms in a woman of sixty years. Dieulafoy has also called attention to certain unusual cases of pneumococcic infections of the

stomach, leading to gastritis and ulceration. Finally, it is important to note that the rôle played by infectious diseases in the production of gastric disturbances is not only important on account of the immediate effects, but that long after the infection has disappeared, definite gastric manifestations may still remain as the result of the inroads made by the infection upon the stomach.

DEGENERATIVE CHANGES.

The degenerative changes of middle life are observed in the form of weakness of the muscle fibers of the stomach; giving rise to atony of the glands, to a diminution of the gastric secretions and atrophy of the mucous membrane. Due to these degenerations there occurs a weakened motility of the stomach with retention of its contents, together with a decrease in digestive power.

These changes frequently lead to the most distressing gastric discomfort, often so severe as to simulate malignant disease. The symptoms arise, however, as a rule, far more gradually and frequently extend over a long period of time.

Fenwick has graphically described the progressive degenerations affecting the secretory structures of the digestive tract in advancing years. He points out that although after the age of fifty these changes are quite constant, careful observation will frequently reveal their presence at a far earlier period of life, even at times at the age of forty.

Microscopically, the pyloric end of the stomach appears attenuated, the rugæ no longer being marked and the mucous membrane appearing very smooth, pigmented and adherent to the adjacent muscular layer. The pyloric orifice is somewhat contracted.

On microscopic examination, the pyloric area presents an increase of connective tissue, which surrounds the tubular glands, resulting in their attenuation. In the early stage of the disease one observes that the columnar epithelium covering the surface of the mucous membrane and of the ducts has disappeared and that the cells of the glands no longer present their normal outlines but are granular in appearance. In a more advanced stage the continued growth of the connective tissue compresses and distorts the glandular tissue

until nothing but minute cysts remain. These finally disappear and the mucosa is converted into a thin layer of connective tissue.

While these changes are progressing in the mucous membrane the submucous layer becomes affected with a similar but less marked form of connective tissue change associated with an obliterative endarteritis, and as a result of compression the intervening muscularis mucosa is destroyed.

At the onset the muscular coat presents signs of hypertrophy but finally interstitial changes manifest themselves and the muscle fibers undergo fatty degeneration or atrophy. These connective tissue changes are rarely observed beyond the central zone of the stomach.

At times degenerative changes are observed in the vessels of the stomach itself, leading to rupture with hemorrhages of a more or less severe type, which are not unfrequently most difficult to distinguish from those occurring in ulcerations. The degenerative changes having their origin in middle life are usually mild and often progress extremely slowly, so that they may be entirely overlooked until the onset of old age, when they become more fully developed.

ARTERIOSCLEROSIS.

Arteriosclerosis is a most important factor in the production of gastric disturbances of middle life. It is observed in one of two distinct types:

1st. Those instances in which the arteriosclerotic changes are primarily in the stomach itself.

2d. Those in which the manifestations are secondary to a general arteriosclerosis. Both conditions play an important rôle as causative factors leading to gastric symptoms of varying degrees.

A study of the arteries of the stomach, in this condition, shows that due to the primary changes in the media and adventitia there is a thickening of the intima which finally involves the media and adventitia.

As a result of the arteriosclerotic changes a definite form of abdominal angina may be produced, associated with paroxysmal attacks of pain of a rather severe type. Harlow Brooks has called attention to the fact that the disturbed visceral

function, with occasional elevation of blood-pressure which cannot otherwise be accounted for, may lead to the suspicion of some localized area of arterial disease and especially when associated with anginal pain located in the abdomen.

Attention has already been directed to the gastric hemorrhages not occasioned by ulceration but produced by degenerative changes in the vessels of the stomach. A frequent cause of these hemorrhages is found in the miliary aneurisms due to arteriosclerosis of the small gastric arterioles.

As arteriosclerosis plays an exceptionally important rôle in the production of the gastric disturbances in middle life, as well as of old age, this condition will be taken up for further consideration in another section. (Page 96.)

TOXEMIA.

Toxemias associated with gastric disease are not uncommon and may be either of exogenous or endogenous origin.

The exogenous forms are caused by the ingestion of concentrated mineral acids or alkalies, or by such poisons as phosphorus or arsenic, or by food infected with certain pathogenic microorganisms.

Due to these toxic substances an intense inflammatory state of the stomach is produced, which is more severe when the poison is swallowed in the fasting state. The parts affected frequently become necrotic, producing varying degrees of sloughing of the mucous membrane, and at times penetrating the submucous and peritoneal coats, occasionally producing perforative peritonitis.

In less severe types a swelling of the mucous membrane takes place with superficial necrosis and hemorrhagic areas, and the epithelium of the glandular tubules undergoes a fatty degeneration.

The endogenous variety of gastric toxemia is far more common than the exogenous form and may have its origin in a great many different causes. Of special interest are those forms observed in certain affections of the stomach itself; next, those of intestinal origin; and finally, those due to disease of distant organs.

Among the gastric affections in which this condition may be especially noted are dilatation of the stomach, both of the

acute and chronic variety, carcinoma and certain forms of chronic gastritis.

Gastric toxemias are not uncommonly produced by intestinal disease. A very striking instance of this condition is to be found in the vomiting due to intestinal obstruction. It may also occur associated with the intestinal toxemias, due to constipation or diarrhea, and in the various forms of intestinal affections, as in dysentery, stasis, mucous colitis and malignant disease.

Gastric toxemias are also frequently observed associated with diseases of distant organs, as the kidneys, genital organs, liver, as well as in diabetes, certain forms of anemia (pernicious anemia, chlorosis), and in pregnancy, and even in endocrine dysfunction.

The effect of disease of other organs upon gastric function is a subject of the greatest importance, to which further attention will be directed in a subsequent section.

SYPHILIS.

Syphilis of the stomach is not an infrequent affection in middle life. According to Gerster, in a series of 1603 cases of gastric disease, 1.6 per cent. was found due to syphilis; and according to the combined statistics from a number of sources the proportion varies between 1.25 and 1.50 per cent. In the largest proportion of instances the cases have occurred during the tertiary stage of the disease, though secondary syphilis is frequently accompanied by symptoms of indigestion due, as a rule, to a toxemic gastritis. Tertiary syphilis may, according to Fenwick, appear in three forms: (1) gummatous formations; (2) in the form of endarteritis; and (3) as chronic inflammation of the mucosa.

1. **Gummata.** Large gummata have not been frequently noted in the stomach, Chiari having observed but three instances. This tumor is usually found in the pyloric area near the lesser curvature, and is frequently multiple. In its growth it often undergoes softening, producing ulceration. The gummatous ulcer can usually be distinguished from the simple form, as it is irregular in shape, its edges over-hanging, its walls and base are soft, dry and bloodless and frequently covered with an adherent slough, and perigastric adhesions

are not uncommon. The mucous membrane adjacent to the ulcer presents indications of chronic inflammation, and is often studded with minute gummata.

It is rare to observe perforation of the stomach in this affection and the usual manifestations of syphilis are present in other abdominal organs (liver, spleen and pancreas).

2. **Endarteritis.** Obliterative endarteritis occurring in the blood-vessels of the stomach is frequently noted in syphilis, though it need not necessarily be indicative of the presence of this disease, for it may occur as well in simple ulcerations and in arteriosclerosis. Syphilitic endarteritis is usually associated with gummata in the liver, spleen, and pancreas, and frequently affects the minute branches of the pyloric vessels in the submucous and subserous connective tissue; as the result of the interference with the nutrition of the wall of the stomach, ulceration may ensue.

3. **Chronic Gastritis.** Chronic gastritis may occur as a direct or indirect effect of syphilis. As a result of the interference with the circulation of the stomach from luetic disease of the liver, spleen, kidneys, etc., a secondary gastritis may be induced. In the luetic gastritis, the mucous membrane is dull and opaque and is usually thickened, due to an increase in the connective tissue between the glands. The gastric glands are frequently observed to be distorted and disorganized by a round cell infiltration, which is usually profuse in the submucosa and glandularis.

The syphilitic origin of the disease is indicated by the miliary granulations, which are observed throughout the entire thickness of the mucosa, and at times even in the submucous tissue there are small areas which are minute gummata which coalesce.

Another characteristic feature of syphilitic gastritis is the marked accumulation of oval, round and spindle cells around the vessels forming concentric rings, encroaching upon the vascular walls and increasing their thickness to a greater or less degree.

The lumen of the vessels is at times markedly occluded and a subendothelial proliferation is not uncommon. In consequence of the cicatricial obstruction about the pylorus, stenosis with gastric dilatation may be produced.

Clinically, syphilis of the stomach may be classified, according to Einhorn, into the following groups: 1, Luetic ulceration of the stomach; 2, syphilitic tumor; 3, luetic stenosis of the pylorus.

A clinical study of this exceedingly important disease of middle life will follow in a subsequent section.

DISTURBANCES OF THE FUNCTIONS OF THE STOMACH IN DISEASES OF OTHER ORGANS.

In a study of the diseases of middle life, it at once becomes apparent that in a large proportion of instances, disturbances of the stomach functions are encountered as the result of diseases of other and often distant organs. At times, especially in the more chronic cases as well as in afebrile forms, the gastric symptoms may present the most marked features, while the actual disease producing the gastric disturbance is only recognized with great difficulty and, therefore, errors in diagnosis not uncommonly occur.

It is on this account that in all dyspeptic conditions, a thorough investigation should always be made into the functions of all of the important organs of the body, as well as the stomach itself, lest an incorrect conclusion be reached.

The cause of the disturbed stomach function due to disease of other organs lies either in some disturbance of the circulation, nervous system, or is due to a special toxemia. In diseases of the heart and liver, portal obstruction is recognized as the cause of the gastric disturbance; in nervous affections there is frequently an alteration of the gastric secretion; while in febrile states, kidney disturbances, tuberculosis, diabetes, and anemia, changes occur in the gastric mucosa due to toxemias specific to the individual disease.

In many instances the gastric disturbance is reflected as a purely nervous manifestation, as is not infrequently observed in the form of pylorospasm occurring in instances of chronic appendicitis, or in cardiospasm in gall-bladder affections.

Among the most important diseases exercising a secondary effect on the stomach during middle life are those of the intestines, lungs, heart, liver, genito-urinary organs, diabetes, pernicious anemia, febrile and nervous affections, a clinical study of which can be found on page 63.

INDISCRETIONS IN DIET.

Indiscretions in food and drink, in addition to the abuse of tobacco, are often potent factors in the production of the gastric disturbances of middle life. These errors in diet may consist in the consumption of food in excessive amounts, often imperfectly masticated and too rapidly bolted, taken too hot or too cold; food over-rich, highly spiced, or fermented or decomposed, introducing microorganisms into the stomach; unripe or overripe fruits; too cold drinks; excessive use of condiments, and over-indulgence in alcohol, coffee, or tea.

There are certain individuals who are affected with so-called "weak or delicate digestion," in whom any variation from a strict diet is at once followed by gastric upsets. In such persons sweets, fatty foods, shell-fish, coffee, alcohol, or tobacco, are quite apt to produce acute gastric catarrhal conditions.

There can be no question but that the lower classes are endowed with better digestion than the better classes, due to the fact that the former are accustomed to eat less digestible food with considerable more residue than the latter, in consequence of which the stomach is trained to digest larger quantities of not readily digestible foods without difficulty.

The acute upsets brought about by the ingestion of excessive quantities or improper food usually causes an acute gastritis, while food taken very hot is believed to be a frequent cause of ulcer and, as W. J. Mayo has pointed out, is a possible factor in the production of cancer of the stomach. On the other hand, Wegele attributes the dyspepsia of many Americans to the taking of ice-cold water and other cold drinks.

When food is consumed too rapidly or is insufficiently masticated the masses entering the stomach are difficult to dissolve in the gastric secretion and act as irritants and may produce acute or chronic gastritis.

It is well to call attention to the fact that the largest proportion of cases of hyperchlorhydria are induced by indiscretions in diet, abuse of alcoholic drinks and tobacco. In an analysis of 542 cases of hyperchlorhydria studied by us, 186 were brought about by these conditions, of which fifty-seven,

or thirty per cent., occurred between the ages of thirty and fifty years.

The following table, taken from Fenwick, presents the relative frequency of errors in food and drink in the production of chronic gastritis:

Alcohol	60.0 per cent.
Errors of diet	17.9 per cent.
Drugs	13.3 per cent.
Tobacco	8.8 per cent.

DISTURBANCES OF THE NERVOUS SYSTEM.

The importance of the nervous system, in its relation to affections of the stomach in middle life cannot be overestimated. Much attention has been directed to disturbances of the digestive system by the more recent studies of the physiology of the nervous system. Through the researches of Langley, Meyer and Gaskell, as well as others, it has been demonstrated that the involuntary nervous system supplies two sets of nerve fibers to every organ, the one functioning as activator, and the other as inhibitor nerves, the two combined, exhibiting a regulating mechanism, controlling the interactivity of both groups.

Through Eppinger and Hess the theory has been advanced that disturbances of the autonomic system leading to increased and decreased tonus or excitability may be the cause of certain pathological changes. According to this theory, the symptoms of nervous dyspepsia are due to disturbances of the internal secretions in consequence of which changes in the excitability or tonus are transmitted through the autonomic system to the stomach. These writers have evolved a clinical symptom-complex according to this idea, which is based on the excitability or tonus of the autonomic system and is termed by them vagotonus and sympathetico-tonus.

Increased vagotonus produces an increase in gastric secretion (hyperacidity and hypersecretion) and peristalsis (nervous vomiting, cardiospasm, pylorospasm). As forms of increased sympathetico-tonus may be mentioned atony of the stomach, achylia gastrica and nervous anacidity.

It is further known that certain drugs have a definite stimulating effect on the vagus and are therefore vagotonic, while others have an inhibiting effect. There are in addition drugs which are sympathetictonic.

Gastric nervous affections may be primary or secondary: they are primary when the seat of the nervous disorder is inherent in the stomach itself, and secondary when the nervous mechanism of the stomach is reflexly affected either from the brain, spinal cord, or some other organ, such as the liver, kidneys, etc. Thus a severe pain such as kidney colic may reflexly affect the stomach, causing vomiting. It has been demonstrated by Gould that severe eye-strain may also have a marked influence in this regard.

Dock has recently called attention to the fact that focal infections may be the cause of certain functional disorders, and that exhaustive treatment in a case of bulimia, by removal of infected teeth and the treatment of nasal and sinus disease, resulted in a cure. On the other hand, a gastric neurosis may in turn reflexly affect other organs, and we may find symptoms, such as headache, palpitation, and insomnia, due to this condition.

According to our experience, fifty-five per cent. of all gastric disturbances can be classified as neuroses, while forty-five per cent. represent organic diseases. In order that a gastric neurosis may exist there must be present some predisposition, that is, a neurotic tendency in the individual. This is frequently first manifested by nervous symptoms directed to other organs, the stomach only becoming involved later. Heredity plays an important rôle.

The manner of development of these affections is often peculiar. At times they begin suddenly, often without any apparent cause or error in diet, persist for a longer or a shorter period of time and then perhaps terminate abruptly; at other times they come on slowly, progress rapidly, and terminate when least expected. Most of the gastric neuroses are observed more frequently in females than males, and more often in the upper than the lower classes. The chief factors in males are overwork, worry and excesses, especially overindulgence in drink. The chief causes in women are disorders of menstruation, reproduction, anxiety, sorrow, and

disappointment. The neuroses rarely begin in old age. They occur more frequently in middle life, between the twentieth and fortieth years.

The following, taken from Friedenwald in Osler's Modern Medicine, presents the incidence of gastric neuroses at various ages:

Years	No. of cases	Per cent.
1 to 20	232	14.5
20 " 30	354	22.5
30 " 40	404	25.0
40 " 50	339	21.5
50 " 60	175	11.0
60 " 70	88	5.5

Forty-six per cent. of this number occurred between the thirtieth and fiftieth years.

The neuroses occur as frequently in the robust and well nourished as in the broken-down and enfeebled individual. After persisting for some time, however, these affections interfere with the general health, often producing emaciation.

DISTURBANCES OF THE ENDOCRINE SYSTEM.

Through the knowledge obtained from the researches of Eppinger and Hess, it is now established that the glands of internal secretion are controlled and regulated through the autonomic nervous system, while on the other hand the activity of this system is, in a measure, dependent upon the secretions of the endocrine glands. According to this theory, therefore, the symptoms of nervous dyspepsia are due to disturbances of the internal secretions, in consequence of which changes in excitability or tonus are transmitted through the autonomic system to the stomach.

This relation has been well illustrated in the experiments of Rogers on dogs. By means of subcutaneous injections of certain extracts of the thyroid, or parathyroid, he was able to produce a marked increase both in the flow of the gastric secretion and in gastric motility, which could be inhibited by means of an injection of atropin.

Not only will atropin inhibit this reaction but a similar effect can be brought about by the injection of an extract of the adrenal gland. Rogers explains the latter reaction as due

to a stimulation of the sympathetic by the extract of this gland.

According to Barker, the relations existing between the endocrine glands and the digestive system may be classified under two main heads:

A. The relation of the digestive apparatus to endocrine organs outside of itself.

B. Internal secretions originating within the digestive apparatus itself.

A. *Relation of the Stomach and the Thyroid Gland.* In Graves's disease the appetite is usually increased, especially in the early stages and there is frequently polyphagia. As the disease progresses the appetite becomes diminished and at times there is complete anorexia. In myxedema, the appetite is usually diminished and there may be complete anorexia, especially for meats.

In Graves's disease the gastric secretion is usually diminished, yet at times a rise of acidity does occur. Vomiting is not uncommon, especially of a paroxysmal type, usually bears no relation to food and frequently is not associated with nausea. In myxedema the gastric secretion is also reduced in quantity and not infrequently a complete achylia exists.

Relation of the Stomach to the Parathyroid Gland. Trousseau was the first (in 1851) to describe the clinical symptomatology of tetany, which is associated with a disturbed function of the parathyroid glands and is also seen in certain gastric disturbances.

There are two groups of cases of this affection: one in which tetany develops in individuals who are affected with chronic gastric disturbances, and another in which the gastric affection occurs about the time of the onset of tetany. The gastric condition most frequently observed in cases of tetany is dilatation.

Barker and Estes have described a syndrome in which chronic dilatation of the stomach exists with tetany and hematoporphyrinuria. The condition occurred in a family of three sisters.

Relation of the Stomach and Hypophysis Cerebri. The symptoms related to the stomach in disturbed hypophysial func-

tion are but few. Dilatation and enlargement of the walls of the stomach have been observed with the polyphagia so often noted in acromegaly. In diabetes insipidus there is a marked polydipsia.

The subcutaneous injection of pituitrin leads first to a decrease followed by an increase in the motility of the stomach.

Relation of the Stomach and the Chromaffin System. Adrenalin, when injected into the blood-vessels, stimulates the sympathetic fibers in the glands, inhibiting peristalsis and causing a contraction of the pylorus.

The relation of the adrenals to the production of ulceration of the stomach is extremely interesting.

It was noted by Gibille in 1909 and Fenza in 1913, that animals dying after removal of both adrenals, were observed to have ulcerations of the stomach. Fenza also demonstrated that if after removal of the adrenals, adrenalin was injected into the circulation, the gastric mucous membrane remained unaffected.

More recently Friedman, from both clinical and experimental evidence, has concluded that these ulcerations are due to disturbances of the internal secretion affecting the nerves supplying these areas.

During the past few years a number of reports bearing upon the relationship between peptic ulcer and disturbances of the adrenals have been published.

Relation of the Stomach and the Interrenal Glands. Digestive disturbances are prominently observed in Addison's disease in the form of a diminished and capricious appetite, eructations, hiccough, fullness after meals and frequently anorexia, nausea and vomiting. Gastric pain is at times present, which is sometimes paroxysmal and may be localized or diffuse. The examination of the gastric secretion in this affection usually reveals an absence of the hydrochloric acid and there is a diminution in the motility of the stomach.

B. *The Hormone of the Pyloric Glands (Gastrin).* The substance known as gastrin (Edkins), or gastric secretin (Baylin), has the power when injected into the circulation of exciting the secretion of the gastric glands at the fundus of the stomach.

Edkins, with an extract of the pyloric mucosa of a fasting cat, was able to produce a secretion of gastric juice containing hydrochloric acid and pepsin when this substance was injected into the circulation of another fasting animal.

Similar results were obtained with meat extracts, and to a less degree, with extracts of glucose or peptones, while extracts prepared from other glands of the stomach excited no secretion.

TRAUMA.

The part played by trauma in the production of the gastric affections of middle life is not of marked importance; yet there is a definite relation, in a small proportion of instances, between this condition and the incidence of certain diseases of the stomach. For a long period of time it was generally held that trauma of the stomach would so far disturb the gastric mucosa as to produce the formation of gastric ulceration. This theory, however, cannot be entirely correct, for Beaumont demonstrated on Alexis St. Martin, that the stomach is markedly resistant to trauma and that repair takes place extremely rapidly. It has also been demonstrated in animals in which destruction of the gastric mucous membrane has been produced, that the mucosa heals rapidly without the production of ulceration; in fact, the healing of injuries of this character is even more rapid than in other regions of the body.

This is probably due to the great vascularity of the stomach, as well as the power of the mucous membrane of contracting, and thus partly covering over and protecting the injured area.

On the other hand, falls, blows, and foreign bodies, have produced massive hemorrhages from the stomach, without, however, the formation of ulceration.

There can be but little question that traumatism, under certain conditions, may be a factor in the production of ulcerations. In a study of one thousand cases of ulcer of the stomach and duodenum reported by us, a definite history of trauma was elicited in twenty-three cases, in ten of which there had been blows upon the abdomen. Fifteen of these occurred in males and eight in females.

The following table presents our twenty-three cases of ulcerations due to trauma, observed in males and females according to age:

Years	Males	Females
20 to 30	3	1
30 " 40	4	3
40 " 50	7	3
50 " 60	1	1
Total	15	8

Of the twenty-three cases sixteen occurred in individuals of middle age.

According to Richardiere, traumatic ulcerations may be divided into two groups:

1. The acute forms which heal rapidly.
2. The forms which heal slowly and which run the course of chronic ulcerations.

It is quite possible to conceive that traumatic factors, such as direct blows on or severe compression of the abdomen, may cause an injury and destruction of the mucous membrane of the stomach, especially at such times when the mucous membrane of the stomach is congested with blood during digestion and the stomach contains considerable quantities of food.

Attention should also be directed to those instances of ulceration occurring in women who employ corsets compressing the stomach, and shoemakers and tailors who are subjected to continuous pressure on the upper abdomen.

THE GASTRIC SECRETION AND MOTILITY IN MIDDLE LIFE.

It has been definitely noted that the general changes that take place as individuals advance in years are similarly accompanied by changes in the gastric secretion and motility. Both Ewald and W. Fenwick have pointed out the occurrence of atrophic changes in the stomach as well as the tendency to the disappearance of free hydrochloric acid, as individuals grow older.

Karjaard was the first to systematically investigate this problem. He studied the functions of the stomach in four

individuals who were over fifty years of age and who did not complain of any gastric disturbance. He found an absence of free hydrochloric acid and concluded that the hypochlorhydria is related to and proportionate to the degree of arteriosclerosis.

In a further investigation upon seventy individuals of middle life and old age, Seidelin observed that free hydrochloric acid was constantly absent in twenty-eight (fourteen per cent.). In only six (ten per cent.) was there a normal percentage of free hydrochloric acid. Of forty-five females, fifteen (thirty-three per cent.) presented an entire absence of free hydrochloric acid, while in twenty-five males, thirteen (fifty-five per cent.) revealed the same condition. In forty-eight cases of marked arteriosclerosis there were twenty-four with an entire absence of free hydrochloric acid, while in twenty-two cases without apparent arteriosclerosis there were but four without free hydrochloric acid.

Seidelin concluded that in a large proportion of individuals of middle life and old age there is an absence of free hydrochloric acid in the gastric contents, there being a special relation between this condition and the degree of arteriosclerosis.

Liefschutz examined the gastric contents of sixty individuals of middle life and over; of these, twenty-five showed a constant absence of free hydrochloric acid. He also found achylia gastrica present in thirty-seven per cent. of his cases and concluded that the gastric secretion has a distinct tendency to diminish at this period of life, and that an absence of the free hydrochloric acid is not an uncommon condition in old age.

In 1908 Friedenwald reported his observations on twenty-seven cases in elderly individuals; in no instance did any case present symptoms indicating the presence of any gastric disorder. Free hydrochloric acid was constantly absent in twelve of the twenty-seven cases (forty-four per cent.). In only five was there a normal percentage of free HCl (eighteen per cent.); of nineteen males, eight (forty-two per cent.) presented an entire absence of free HCl, while of eight females, four (fifty per cent.) presented this condition. In eighteen cases of marked arteriosclerosis there were ten with an en-

tire absence of free HCl, and six with a subnormal amount of free HCl, while in nine cases without arteriosclerosis there were but two without free HCl. As a further evidence of the fact that the gastric secretion has a tendency to diminish as individuals grow older, Liefschutz draws attention to the fact that thirty-seven per cent. of his cases of achylia gastrica occurred in individuals over the fiftieth year of age. According to our own observation, this percentage is forty. The following table, taken from Friedenwald in Osler's Modern Medicine, indicates the number of cases of achylia gastrica at various ages among one hundred and twelve cases:

Years	Males	Females
up to 20	1	1
20 " 30	5	8
30 " 40	10	9
40 " 50	18	15
50 " 60	15	20
60 " 70	6	4

From our former observations, as well as from those of Liefschutz and others, it is evident that the gastric secretion has a tendency to diminish in advancing years and in a degree proportionate to the arteriosclerosis, and it is, therefore, unwise to attach too much importance to the absence of this secretion in individuals advanced in years, in the diagnosis of cancer of the stomach.

From more recent investigations of the gastric secretion and motility in individuals of middle life our former observations have been confirmed. These examinations were made by means of fractional analyses on one hundred patients affected with various gastric disturbances taken in regular order, and compared with a similar number of cases in young individuals under like conditions.

TABLE COMPARING THE ACIDITY AND MOTILITY IN ONE HUNDRED PATIENTS OF MIDDLE LIFE WITH A SIMILAR NUMBER OF YOUNG INDIVIDUALS.

Years	Normal acidity cases	Hyper-acidity cases	Sub-acidity cases	Anacidity cases	Normal motility cases	Hyper-motility cases	Hypo-motility cases
20 to 40	45	34	12	9	55	29	16
40 to 55	39	28	15	18	35	22	43

From these observations it is evident, that while in youth hyperacidity is more frequent than subacidity, that in middle life hyperacidity is of less frequent occurrence, and subacidity and anacidity are more common.

On the other hand, hypermotility is more frequent in youth and atony in middle life.

THE INCIDENCE OF DISEASES OF THE STOMACH IN MIDDLE LIFE AS REVEALED BY AN ANALYSIS OF 500 CASES.

In order to establish the incidence of the various gastric affections in middle life an analysis of the records of five hundred cases, taken in rotation, was made and the results tabulated.

Diseases	No. of cases	Per cent.
Acute and chronic gastritis, including achylia gastrica	55	11.0
Ulcer	42	8.4
Cancer	69	13.8
Dilatation	35	7.0
Ptosis	69	13.8
Syphilis	10	2.0
Secondary gastric affections	99	19.8
Nervous gastric affections	74	14.8
Visceral arteriosclerosis	33	6.2
Unclassified	14	2.8
Total	500	100.0

INCIDENCE OF THE GASTRIC DISORDERS OF MIDDLE LIFE ARRANGED ACCORDING TO AGE AND SEX.

Diseases	Acute and chronic gastritis		Ulcer		Cancer		Dilatation		Ptosis	
Sex	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Ages in years										
40 to 45	7	4	14	7	5	6	5	4	9	16
45 to 50	13	6	8	3	8	17	5	3	10	12
50 to 55	11	14	6	4	18	15	10	8	8	14
Total	31	24	28	14	31	38	20	15	27	42

INCIDENCE OF THE GASTRIC DISORDERS OF MIDDLE LIFE ARRANGED
ACCORDING TO AGE AND SEX (*continued*).

Diseases	Syphilis		Secondary gastric affections		Nervous gastric affections		Visceral arteriosclerosis	
Sex	M.	F.	M.	F.	M.	F.	M.	F.
Ages in years								
40 to 45	1	0	10	13	12	15	5	2
45 to 50	3	2	19	12	10	11	9	4
50 to 55	4	0	26	19	11	15	7	6
Total	8	2	55	44	33	41	21	12

According to the classification above noted the secondary gastric affections form the largest proportion of the gastric affections of middle life, 19.8 per cent; next in number are the nervous gastric affections, 14.8 per cent.; followed closely by cancer, 13.8 per cent.; ptosis, 13.8 per cent.; chronic gastritis and achylia gastrica, 11.0 per cent.; ulcer, 8.4 per cent., and visceral arteriosclerosis, 6.2 per cent.

DESCRIPTION OF THE DISEASES OF THE STOMACH AS REVEALED IN MIDDLE LIFE.

ACUTE AND CHRONIC GASTRITIS.

In our five hundred patients of middle life, fifty-five (or eleven per cent.) were affected with gastritis. Arranged according to age and sex these individuals may be classified as follows:

Ages in years	Male	Female
40 to 45	7	4
45 " 50	13	6
50 " 55	11	14
Total	31	24

Of the fifty-five cases, ten represented the acute form, while forty-five were cases of chronic gastritis and achylia gastrica (atrophic gastritis).

Simple Acute Gastritis.

Etiology. Acute gastritis is not uncommon in middle life, occurring among individuals whose digestion is impaired and in whom proper mastication is prevented by the absence of proper dentition. It not infrequently occurs as the result of errors in diet, food taken too hot or too cold, too highly spiced or fermented, unripe or decayed food, or over-indulgence in alcohol. Acute gastritis is not uncommonly observed as secondary to acute infections.

Pathology. In acute gastritis there is an acute inflammation of the superficial layers of the mucous membrane with an increased secretion of mucus and a desquamation of the glandular epithelium. The mucous membrane is reddened and swollen. While at the onset the gastric secretion may be normal in quantity or increased, it is soon diminished. The superficial epithelial cells undergo cloudy swelling and the principal and parietal cells can no longer be distinguished and are in a state of cloudy swelling and fatty degeneration. Round cells are found in the interglandular tissue and the capillaries are dilated. There are at times slight hemorrhages in the mucosa, and bacteria of various types are not infrequently observed.

Symptoms. The symptoms vary according to the intensity of the attack. In most instances there is discomfort in the abdomen, loss of appetite, nausea and vomiting; though the vomiting may be absent. In more severe cases there is pain in the region of the stomach, excessive nausea and vomiting, headache, and temperature of 100° to 103° F., the tongue becomes furred and the pulse rapid. The vomitus has often a rancid odor and consists first of food and then of mucus and finally bile. The vomited matter contains no free HCl but lactic and other organic acids are present.

The duration of this affection is short, lasting from three or four days, to a week.

Inasmuch as certain infectious diseases, such as typhoid fever, as well as cholecystitis, appendicitis and enterocolitis, have in their onset identical signs as one finds in acute gastritis, one should constantly be on the watch for such affections, otherwise grave errors may occur.

Treatment. The treatment should be directed to a thorough evacuation of the stomach, which is usually promptly brought about by vomiting, but if this does not take place the stomach should be quickly emptied, preferably by means of the stomach tube, or if this is impossible, by means of emetics. The patient must be given complete rest in bed and starvation practiced until nausea has entirely abated. Hot stupes should be applied to the abdomen and calomel given in minute doses at half hour or hour intervals until one to two grains have been taken.

If acid eructations are disturbing the patient, bicarbonate of soda or milk of magnesia can be administered. No food should be allowed until vomiting has entirely ceased. But bits of ice will often relieve the nausea and vomiting, when milk, to which lime water has been added, may be given in small quantities and food gradually increased according to the condition of the patient.

Toxic Gastritis.

Etiology. Toxic gastritis occurs as the result of chemical poisons, as the swallowing of strong alkalis or mineral acids in concentrated form, or is produced by such poisons as arsenic, corrosive sublimate, or phosphorus.

Pathology. The result of these poisons is a destruction of the parts attacked, causing a varying degree of necrosis of the mucosa, at times the submucous layer or the entire wall of the stomach is involved with a resultant perforative peritonitis. Hemorrhagic areas are commonly produced with a granular and fatty degeneration of the glandular tubules.

Symptoms. These vary with the degree of involvement. There is intense pain and burning in the epigastrium and esophagus with nausea and vomiting; the vomitus being streaked with blood and filled with ropy mucus. There is marked salivation and dysphagia.

The abdomen is tender and distended, and intense thirst is a prominent symptom. Collapse is not uncommon, the pulse becoming small and rapid and the respirations shallow, and death may ensue in coma or convulsions.

Treatment. Of prime importance is the rapid removal of the poison from the stomach, which can be best accomplished

by immediate lavage. The poison should as far as possible be diluted and neutralized. In case of acid poisoning alkalis are indicated in the form of milk of magnesia or soda; in alkali poisoning acids such as dilute citric or acetic acids are indicated. An ice-bag should be placed over the stomach and cracked ice given by mouth, and morphin must be administered hypodermically for the relief of pain.

Phlegmonous Gastritis.

Phlegmonous gastritis is a rather rare affection. It is observed as a purulent inflammation of the gastric walls, having its origin in the submucosa and gradually involving the other layers.

Etiology. The cause is often difficult to determine. It has been observed as the result of trauma, small-pox, puerperal fever and pyemia. In some manner the gastric wall loses its resistance and a focus of infection by streptococci develops. The affection may appear as a diffuse phlegmonous gastritis or may be circumscribed (abscess of the stomach).

Pathology. The most marked change is observed in the submucosa, which is thickened and covered with a purulent secretion, while the muscular coat presents a degeneration of the muscle fibers; the serous coat may also be involved. The pyloric area of the stomach is most frequently affected.

Secondary involvement is not uncommon, suppurative splenitis, purulent peritonitis, pericarditis and liver abscess being among the lesions which have been noted.

Symptoms. The symptoms are extremely alarming. There is always present a violent gastritis associated with pain, nausea, vomiting and high temperature; in addition, rapidity of the pulse, extreme weakness and prostration and marked toxemia are observed.

This affection is ordinarily fatal in a few weeks and at times even in a few days.

Treatment. The treatment is mainly symptomatic though surgery is indicated if the disease can be recognized reasonably early. From a medicinal point of view but little can be accomplished. The stomach must be spared all food and the patient should be fed by means of rectal enemata. Morphin must be administered hypodermically.

Membranous Gastritis.

But little need be noted regarding this very rare affection, which is caused by the formation of a diphtheritic membrane upon the mucosa of the stomach, due either to the diphtheria organism, pneumococcus or streptococcus.

Treatment. The treatment of this condition is symptomatic unless the diphtheria organism be noted as the cause, when diphtheria antitoxin should be utilized.

Chronic Gastritis.

Chronic gastritis may be a primary or secondary affection. The secondary form will be fully described under that special group known as secondary gastric disorders. As a primary disease it has occurred in forty-five of our five hundred cases of middle life. We have embodied in this division, however, fifteen cases of achylia gastrica due to chronic atrophic gastritis.

Etiology. Chronic gastritis may occur as the result of a prolonged or recurrent acute gastritis; and often appears in association with other affections of the stomach, as cancer, ulcer or dilatation. The most frequent causes are, errors in diet, the too rapid ingestion of coarse and indigestible food which is not thoroughly masticated, as well as the abuse of alcohol and tobacco. It is not unlikely that neglect in the care of the mouth, infected tonsils, and decayed and abscessed teeth, or sinus infections may be potent factors in the production of this affection due to the chronic bacterial invasion and intoxication.

The following table illustrates the thirty cases of chronic gastritis in our series, arranged according to age and sex:

Ages in years	Male	Female
40 to 45	3	2
45 " 50	7	1
50 " 55	7	10

Pathology. The involvement is not limited, as a rule, to the superficial layers of the mucosa, but extends to the glandular layer and interstitial tissue. The epithelial layer is early involved and covered with mucus.

The glands undergo degeneration in the form of cloudy swelling or atrophy, and there is both parenchymatous and interstitial inflammation present, it being impossible to distinguish between the principal and parietal cells.

There is also present a marked round cell infiltration and connective tissue proliferation, choking many of the lumina of the glands and thus interfering with their normal function. At first the glands elaborate an excess of secretion, but as the disease progresses it becomes lessened in amount until atrophy occurs, when the secretion entirely disappears. The mucous glands continue to pour out large quantities of mucus and at the same time this secretion is increased by a mucoid degeneration involving the tubules as well as the fundus of the peptic glands.

The connective tissue increases in quantity, especially about the pylorus, so that even stenosis of the pylorus may be produced (stenosing gastritis).

In more severe forms of this disease even the muscular layer of the stomach may become involved in the connective tissue proliferation to such a degree as to cause a reduction in size of the stomach, interfering with its motility.

By the progressive increase of the connective tissue complete destruction of the glandular area may be brought about, leading to a complete achylia gastrica.

In the aggravated forms of the disease, bacteria (streptococci, staphylococci, and other organisms) may be found in the glandular and interstitial layers of the stomach.

In a small number of instances in middle life in individuals presenting the signs of arteriosclerosis, these sclerotic changes involve the gastric arteries, producing chronic gastritides of the mucous type.

Symptoms. The symptoms of chronic gastritis appearing in middle life differ but little from those occurring at other ages, in fact, the manifestations are frequently extremely vague and not distinctive, much resembling those observed in other gastric disturbances.

The usual signs are, loss of appetite, often anorexia, disagreeable taste, coated tongue, fetid breath, and eructations. Not uncommonly nausea is present and patients complain of fullness and pressure after meals, palpitation, vertigo, head-

ache, and constipation, or constipation alternating with diarrhea.

In a certain group of these cases, especially in patients of middle life, one notes relief from gastric distress after meals, with discomfort several hours after meals (hunger sensation). Allan A. Jones has called attention to this condition, and our observations are entirely in accord with his. It is quite likely that notwithstanding the absence of free hydrochloric acid in these cases, the hyperesthesia of the gastric mucosa due to inflammation produces this condition. According to our experience the symptoms of these patients are aggravated by the administration of acids.

Many patients tolerate this affection extremely well and present no untoward symptoms, while others lose in weight and strength, and complain constantly of discomfort. In the alcoholic subject the morning vomiting of large quantities of ropy mucus is familiar to many.

On physical examination of patients affected with chronic gastritis one notes usually a grayish coated tongue, although this organ may be entirely clean, an offensive breath and a moderate tenderness over the entire region of the stomach, with some distention of this area.

The diagnosis of chronic gastritis cannot be made from the symptoms already noted without the finding of large quantities of mucus. The presence of the mucus can be ascertained in the vomitus or in the gastric contents obtained through the tube. This mucus is ropy and thick and contains large numbers of cells, free polymorphonuclear leucocytes being especially significant. In the early stages of chronic gastritis there is often a hyperacidity, frequently called acid gastritis, but this condition is rarely observed in middle life, for with the progress of the disease as the patient reaches this period of his life the acidity has diminished below normal and anacidity is usually present. With the diminution of the free HCl the pepsin and rennet are reduced in amount, and finally that stage of the disease occurs when there is a complete atrophy of the secreting glands, the stage at which restitution is no longer possible.

Prognosis. The prognosis of chronic gastritis is favorable, providing the causative factors can be eliminated. The prog-

nosis must, however, be guarded, for notwithstanding the material relief which may be obtained in most instances, relapses are not uncommon.

Atrophic Gastritis (Achyilia Gastrica).

Einhorn introduced the term *achyilia gastrica* to denote an absence of gastric secretion. There are two distinct varieties of this affection. The one form a result of chronic atrophic glandular gastritis and the other a neurosis. We are here only considering the former affection, the latter condition being referred to later on in the section on gastric neuroses. Cases accompanied by a complete atrophy of the gastric mucous membrane, such as were first described by Fenwick and such as have been observed in pernicious anemia, are included in this group. In this affection we observe the final stage of a chronic anacid gastritis with atrophy of the glands.

There is a senile form of *achyilia gastrica*, often occurring in middle life in arteriosclerotic subjects, in whom senile atrophy occurs following a chronic atrophic gastritis. *Achylias* of this form also occur in carcinoma of the stomach, at times in chronic cholelithiasis and in pancreatic diseases.

The following table illustrates the fifteen cases of *achyilia gastrica* in our series, arranged according to age and sex:

Ages in years	Male	Female
40 to 45	2	1
45 " 50	4	3
50 " 55	3	2

Etiology. In order to determine the presence of *achyilia gastrica* a fractional analysis of the gastric contents according to the Rehfuß method is extremely important, as only by employing this method is it possible to differentiate the true from the spurious forms. In true *achylias*, free hydrochloric acid is absent in every specimen and the total acidity is low. We also observe degenerative changes in the small fragments of the mucous membrane that are broken off by the stomach tube, indicating the anatomical basis of this affection.

Symptoms. The symptoms of *achyilia gastrica* are variable. They may resemble those of chronic gastritis or may

be referable to other organs than the stomach. The gastric symptoms are, nausea, vomiting, eructations, discomfort after meals, and anorexia; these manifestations may, however, be entirely absent and the patient may only complain of diarrhea. A fair degree of health may often be maintained as long as the intestine functions normally; should diarrhea, however, set in, extreme emaciation and weakness will ensue.

The symptoms of this affection are often very indefinite and the disease may only be recognized after test meal examinations.

Treatment of Chronic Gastritis and Achylia Gastrica. The treatment of both of these conditions is essentially the same; that is, mainly *dietetic*. Although it is necessary to restrict the diet, it is essential to insist on the ingestion of sufficient nourishment, as many of these patients are weak and have lost flesh. An attempt should be made to increase the general nutrition, and on this account the motor function of the stomach should as far as possible be maintained in its normal state, and any disturbance of the intestinal canal should be guarded against. It is important to arrange the diet so that it can be digested easily by the intestinal juices. The food must be broken up into as fine particles as possible and should to a large extent be given in liquid and semi-solid form. Of the liquids, broths such as barley, rice or chicken, are to be recommended. Vegetables are usually well borne and should be eaten after the removal of the cellulose. Peas and beans, strained and taken in the purée form, are especially useful. Potatoes and rice should be eaten cooked with broth or milk or as a mush. Eggs are best taken soft boiled. Meats must be given in the most digestible forms, *i.e.*, scraped beef, brains, boiled sweetbreads, and these only in small amounts. Raw oysters and boiled white fish are permissible. Milk is badly borne at times, and cream, koumiss, or matzoon, may be substituted. Butter may be eaten liberally on stale bread or toast. Cocoa may be allowed as well as weak coffee or tea.

Lavage is to be recommended in those instances in which there is marked increase in the mucus secretion, fermentation or impairment of gastric motility.

Drugs are only of secondary importance, though in some instances, especially those characterized by an absence of

HCl, full doses of dilute hydrochloric acid are useful, its efficacy being increased by the addition of pepsin.

In many instances of achylia gastrica pancreatin in combination with bicarbonate of soda serves as a useful digestant. For the anorexia bitter tonics, such as strychnin or nux vomica with gentian or cinchona, are recommended.

ULCER.

Ulcer of the stomach is a common disease in middle life. It is characterized by more or less destruction of the mucous membrane of the stomach. This lesion exhibits no tendency to heal and is attended, as a rule, with definite symptoms.

Etiology. In the study of our five hundred cases of gastric disturbances of middle life, there were forty-two instances of gastric ulcer, or 8.4 per cent.

Arranged according to age and sex, these cases may be classified as follows:

Ages in years	Male	Female
40 to 45	14	7
45 " 50	8	3
50 " 55	6	4
Total	28	14

This table illustrates that gastric ulcer occurs more frequently in males than females, during middle life.

In a clinical study of a thousand cases of ulcer of the stomach and duodenum reported by us, this affection occurred in 357 instances between the thirtieth and fiftieth years of age, that is, 35.4 per cent., which indicates the great prevalence of this disorder during middle life. The following table, taken from our study, illustrates the incidence of ulcer in males and females, according to age:

Age	Cases	Per cent.
0 to 10	2	0.20
10 " 20	162	16.20
20 " 30	345	34.50
30 " 40	229	22.90
40 " 50	128	12.50
50 " 60	93	9.30
60 " 70	38	3.80
Over 70	3	0.30

Etiology. The etiology of ulcer has not yet been entirely satisfactorily established, and it is probable that a combination of factors contribute to its formation. As has already been noted, under the heading of Trauma, ulcerations may be produced by injury, yet blows on the abdomen are rarely the cause of this condition. Inasmuch as the largest proportion of gastric ulcers are situated on the lesser curvature, near the pyloric area, that portion which is subjected to the greatest irritation, it is possible that the trauma produced by the mass of gastric contents, before it has become thoroughly liquefied, is a factor in the production of this affection.

A further explanation has also been noted, founded on disturbances of the circulation; due to vagatonia constriction of the small vessels in special areas, destruction of the mucosa by the acid chyme occurs.

The cause of a certain proportion of ulcerations is a hemogenous infection with special strains of streptococci absorbed from certain foci of infection. Rosenow's work has materially altered our views regarding the etiology of ulcer in these cases, for he has been able to isolate these strains from the ulcer base in man, and with them has shown that they have an elective affinity for the stomach wall of animals when injected intravenously.

The method of production of the ulceration is an infection of an embolic streptococcic type in the submucous layers of the stomach with the production of hemorrhagic areas in the surrounding tissue; in consequence of which anemic necrosis takes place, followed by the digestion of the overlying mucous membrane by the gastric secretion.

The ulcerations found in man differ materially from those produced in animals in that in the former there is a marked retardation of the healing process, while in the latter healing occurs rapidly.

Sippy has attributed delayed healing to the corrosive effect of the acid gastric juice and notes that by constant neutralization of the acid chyme, healing may be brought about.

Pathology. Gastric ulcers vary in size from small areas the size of a pea, to extensive processes involving large portions of the stomach. They are round or oval in shape, and in the large proportion of instances involve the posterior sur-

face of the lesser curvature at the pyloric area. The localization of gastric ulcers, according to Sippy, is noted as follows:

Lesser curvature	35.0	per cent.
Posterior wall	30.0	" "
Pylorus	12.0	" "
Anterior wall	9.0	" "
Cardia	6.5	" "
Fundus	3.0	" "
Greater curvature	3.5	" "
Anterior and posterior wall	1.0	" "

In the largest proportion of cases, ulcers are single, though two or more have been noted. Due to the tendency of ulcers to penetrate deeply, the base may be found in the muscular or serous coat. In the perforating type, the base is formed by the adjacent viscera.

Ulcers are usually funnel shaped, appearing as excavations in the stomach wall, with the submucous, muscular or serous coat as the base. Surrounding the ulcer is a callous base, which at times undergoes carcinomatous degeneration. Due to cicatrization of an ulcer situated at the pylorus, stenosis of the pylorus may be produced. In some instances, necrosis may proceed rapidly; producing a sudden perforation or a blood-vessel may become eroded, causing hemorrhage.

Symptoms. The symptoms of gastric ulcer depend largely upon its size, depth and location. At first the symptoms are indefinite, manifesting themselves by slight discomfort after food, with signs of hyperacidity. Soon, regurgitation, nausea, or vomiting, may develop and finally, the typical evidence of pain presents itself. This appears soon after, or an hour or more after the ingestion of food, and is aggravated by certain types of food. Acids and the heavy vegetables and fruits increase the pain; while on the other hand, proteins, in the form of milk and eggs, relieve it. As a rule, liquids are better borne than solids. The pain is often of a paroxysmal type and may become intense. On account of the pain, patients of their own accord become disinclined to eat and in consequence lose flesh and strength.

In some instances the pain is of the hunger type, appearing some hours after meals and is relieved by the ingestion of food. This phase, however, is far more characteristic of du-

odenal ulcer. Relief may be afforded, not only by food, but also by rest and by the administration of alkalies.

The pain is usually localized in the epigastrium, below the ensiform cartilage. This area is tender to pressure. Boas has called attention to a dorsal tender area, to the left of the median line, between the tenth and twelfth dorsal vertebræ.

Vomiting may occur, sometimes after meals; usually at the height of pain, after which the pain is relieved. In many instances, vomiting does not occur, though nausea is an evident symptom.

Hemorrhage may be slight and consequently may remain unobserved for a considerable time. When present in the "occult form" chemical tests will reveal its presence, either in the vomitus or stools. When the hemorrhage is profuse, other symptoms are evident, *i.e.*, faintness, dizziness, thirst and pallor. Finally, the finding of blood in the stools reveals the exact condition.

According to our experience, hematemesis occurs in twenty-two per cent. of cases, while melena occurs in fifty-one per cent. On the other hand, occult blood was determined in the feces in eighty-six per cent.

Perforation occurs, according to Patterson, in about seven per cent. of all cases of peptic ulcer; it occurred in only one per cent. of our cases. It is the most serious manifestation of gastric ulcer and one of the most frequent causes of death. Perforation is evidenced by excruciating abdominal pain, appearing suddenly and associated with signs of collapse, syncope, weakened pulse, absence of hepatic dullness, and other evidences of peritonitis; only early operation will save such patients.

In the more chronic forms of perforation, in which a plastic exudate has been produced, adhesions are formed to neighboring organs, preventing the escape of the gastric contents into the abdominal cavity.

Diagnosis. The diagnosis of gastric ulcer is arrived at from the symptoms of hematemesis, melena or appearance of occult blood in the stools; pain, vomiting, from the gastric analysis, x-ray signs, and Einhorn's string test.

While hematemesis occurs in twenty-two per cent. of all cases, it appears in thirty-one per cent. of the ulcers of middle

life, indicating that hemorrhage is more frequent at this period of life, and of the five hundred and fifteen cases with melena of our one thousand cases of peptic ulcer, one hundred and fifteen (or twenty-two per cent.) occurred during middle life.

The presence of occult blood in the stools is of great value in diagnosis, being present in eighty-six per cent. of cases; its continued persistence indicating the non-healing of the ulcer or the presence of carcinoma, while its gradual disappearance is indicative of cicatrization.

The significance of pain and vomiting has already been described. The presence of pain together with a tender epigastric area and a tender dorsal area is of importance in diagnosis.

It is also of importance to note the periods of intermission of pain as well as of the other symptoms, varying often from one to twelve months or more, as significant signs in the clinical course of this disease.

Hyperacidity is usually noted in gastric ulcer. According to our observations of eight hundred and ten cases, normal acidity was observed in forty-six per cent.; hyperchlorhydria in thirty per cent.; hypochlorhydria and anacidity in twenty-three per cent. These values were obtained with the one-hour extraction after an Ewald meal. From our recent investigations in ulcer cases by means of fractional analysis, we have arrived at the conclusion that it is unusual not to observe hyperacidity some time during the digestive period, and that hyperchlorhydria occurs far more frequently than was formerly supposed. This, however, pertains to individuals of all ages.

In our forty-two instances of ulcer of middle life, normal acidity was observed in thirty-five per cent., hyperacidity in forty-two per cent., and subacidity and anacidity in twenty-three per cent., indicating that there is a tendency even in middle life to a general reduction in acidity, a condition which we have already pointed out.

The roentgen ray renders important aid in the diagnosis of gastric ulcer. From a study of seven hundred and forty-three cases reported by Baetjer and Friedenwald, the following conclusions were drawn:

The x-ray offers most valuable aid in the diagnosis of peptic ulcer and although this method is not yet sufficiently well developed to be relied upon alone without entering into the clinical aspects of the disease, it is of the greatest diagnostic help in obscure cases. Positive x-ray findings are noted in about eighty-four per cent. of cases of peptic ulcers and in seventy-nine per cent. of cases operated upon.

The String Test of Einhorn. This test is extremely valuable in determining the presence and location of an ulcer. It is especially useful when x-ray signs are doubtful or after operations on the stomach, the distortion of the stomach often rendering the x-ray signs difficult to interpret.

Complications. Of the important complications the following may be noted: pyloric obstruction, hour-glass stomach, perigastric adhesions, hemorrhage, subphrenic abscess, perforation, and secondary carcinoma.

Treatment. The treatment of peptic ulcer during middle life varies but little from that at other ages.

Inasmuch as this disease is at least in some instances due to focal infection, previous to instituting treatment all sources of focal infection should as far as possible be removed. Aside from removing all focal infections, much can be done prophylactically by means of a carefully selected diet, in preventing the onset of ulcer of the stomach. As soon as the first symptoms appear the patient should be placed upon an exclusive milk diet. The temperature of the food should be regulated so that it be given not too hot and not too cold. Anemia and hyperchlorhydria must as far as possible be overcome.

Certain advances have been made in the medical treatment of gastric ulcer in the past few years. According to the older plan, the Leube treatment was almost constantly followed. This consists in placing the patient at complete rest in bed for fourteen days or more, upon a liquid diet consisting mainly of milk. Upon such a diet the patient frequently loses much flesh as well as strength. On this account Lenhartz advises against the strict abstinence cure, even in those instances in which there is hemorrhage.

In the Lenhartz cure an absolute rest in bed for at least four weeks is maintained. On the first day, even though

there be hematemesis, two hundred cubic centimeters of iced milk are given in teaspoonful doses with two ice-cold beaten up eggs. The milk is increased one hundred cubic centimeters daily and an additional egg added; raw scraped beef is added on the sixth day, and on the seventh and eighth days the patient is given rice and softened zwieback.

More recently Sippy has evolved a method of treating peptic ulcer, which, according to our observations in a large number of cases, has yielded the most gratifying results.

Inasmuch as it is generally admitted that a peptic ulcer heals if its surface is not continuously exposed to the digestive action of the gastric juice, Sippy's treatment consists in protecting the ulcer from the acid corrosion until it is healed by shielding it from the corrosive effect of the gastric secretion. He accomplishes this by maintaining a neutralization of the free hydrochloric acid, from early in the morning until late at night, usually from 7 A.M. to 10.30 P.M., or during the entire period when food or gastric secretion is in the stomach.

If an excessive secretion is present at night, this is removed by aspiration until the secretion has disappeared. The neutralization is effected by frequent feedings and the administration of alkalies given freely and at frequent intervals. Nourishment is given from the onset of the treatment; preliminary starvation and administration of nutrient enemata common to other forms of treatment are of little value. The patient remains in bed for three to four weeks.

Three ounces of a mixture of equal parts of milk and cream are given every hour from 7 A.M. to 7 P.M. After a few days, soft eggs and well cooked cereals are gradually added, until in ten days the patient receives three ounces of milk and cream mixture every hour, three or four boiled eggs, and nine to twelve ounces of cereal each day. Cream soup of various kinds, vegetables, purées, and other soft foods, may be substituted now and then as desired.

There can be no question but that a large proportion of ulcer cases recover under this plan of treatment. Of four hundred and three cases of ulcer reported by us, eighty-six per cent. recovered under the Sippy cure.

In those instances in which the ulcer is of a severe type associated with excessive vomiting, pain or hematemesis, food by mouth should be withheld for three to five days and the patient fed by rectum. A Murphy drip, consisting of normal salt solution and containing glucose, is especially to be recommended. In case of hemorrhage an ice-bag should be placed over the epigastrium and morphin must be given hypodermically; thirst is to be overcome by small bits of crushed ice. But little effect is obtained by means of the usual hemostatics. The writers have, however, observed splendid results by means of blood transfusions.

Of the greatest importance in the treatment of certain cases of ulcer, especially those of a severe type, accompanied by excessive vomiting and nausea, is the method devised by Einhorn, known as duodenal alimentation. By means of this method, food can be introduced directly into the duodenum.

Of the remedies employed in the treatment of gastric ulcer, atropin appears to have an almost specific effect in some instances; by depressing the vagus fibers it decreases the secretory and motor functions of the stomach and thus promotes healing.

Bismuth preparations, scarlet red, nitrate of silver, and olive oil, have been recommended.

Surgical Treatment. Simple uncomplicated gastric ulcers do not require operations. Operation must only be considered when there are complications, or when the ulcer has resisted a thorough medical treatment; especially is operation indicated in those cases accompanied by severe and persistent pain, vomiting, or hemorrhage, or in pyloric ulcers accompanied by stenosis. In ulcers situated at other parts of the stomach, operation gives but slight relief unless radical procedures (resection or excision) are undertaken. Operation should be promptly practiced in all cases of perforation, and ulcers of the stomach accompanied by tumor formation always demand surgical intervention. The character of the surgical procedure to be selected is of the greatest importance. This, of course, must vary according to the situation and extent of the ulcer; thus the beneficial effect of gastroenterostomy is dependent upon the proximity of

the ulcer to the pylorus—the closer to the pylorus, the better is the prognosis.

According to Finney and Friedenwald, the results of pyloroplasty and pylorotomy are far better than gastroenterostomy. There were 90 per cent. of immediately successful recoveries and 86.6 per cent. of satisfactory end results following pyloroplasty, while there were but 82 per cent. of satisfactory immediate recoveries and 77.2 per cent. of satisfactory end results following gastroenterostomy.

Healing of Ulcers. Attention must be directed to the question as to what means we possess of determining whether an ulcer has really healed, other than that indicated by the relief of symptoms. Baetjer and Friedenwald were among the first to call attention to the fact, and other clinicians have since corroborated this finding, that the degree of healing can be determined by means of the x-ray, *i.e.*, by making roentgen ray observations over a long period of time during the course of treatment, we are enabled to determine the progress of healing and note when the ulcer has healed. This method has been utilized by us to great advantage in many instances.

After-treatment of Ulcers. There can be but little question that relapses are frequently due to indiscretions in diet following the cure, when the patient is no longer under the control of his physician. The patient should be placed upon a carefully regulated diet free from acids and indigestible foods; intermediate feeding should be prescribed and alkalis be administered for some months following the cure.

CANCER.

Cancer of the stomach is a common disease of middle life.

According to W. H. Welch, next to the uterus, the stomach is most frequently the seat of this disease. In an analysis of 30,000 cases, he finds the stomach involved in 21.4 per cent. In a clinical study of 1000 cases of cancer of the stomach made by us, this affection occurred in 9.6 per cent. of patients afflicted with various gastric disturbances, while peptic ulcer only appeared in 7.8 per cent. W. J. Mayo maintains that nearly one-third of all cancers occur in the stomach. In a Census Bureau report it is estimated that

of a total of 140,088 deaths from cancer, the stomach and liver combined constituted 36.4 per cent. The incidence of this disease varies in different countries; Griesinger maintains that it never occurs in Egypt, while it is extremely prevalent in the United States, Germany and Switzerland.

Welch observes that three-fourths of his cases occurred between the ages of forty and seventy. In our study of 1000 cases of cancer of the stomach, the maximum liability of the disease lies between the fortieth and sixtieth years (sixty-five per cent.), the greatest number of cases occurring between the fiftieth and sixtieth years. In an analysis of 150 cases of cancer of the stomach reported by Osler, sixty-two (41.3 per cent.) occurred between the ages of forty and fifty-five years, while fifty-eight per cent. occurred between forty and sixty. In our study of 500 cases of the gastric disturbances of middle life, cancer of the stomach occurred in sixty-nine cases (13.8 per cent.); of these there were eleven between the ages of forty and forty-five; twenty-five between forty-five and fifty, and thirty-three between fifty and fifty-five.

The disease is slightly more frequent in males than females; according to Welch, 1233 males to 981 females, and according to Osler, 126 males to 24 females. In our 1000 cases there were 588 males and 412 females. The following table, taken from our clinical study of 1000 cases of cancer of the stomach, illustrates the number of cases observed in males and females, according to age:

Years	Males	Females	Total
20 to 30	3	1	4
30 " 40	23	14	37
40 " 50	125	136	261
50 " 60	249	146	395
60 " 70	143	75	218
70 " 80	45	40	85
Total	588	412	1000

The study of our cases of middle life reveals the following incidence:

Ages in years	Male	Female
40 to 45	5	6
45 " 50	8	17
50 " 55	18	15
Total	31	38

Cancer of the stomach is more frequent in the white than the colored race. According to the statistics of our 1000 cases, there were 948 whites to 52 colored—that is, 94.8 per cent. whites and 5.2 per cent. colored. Of the fifty-two cases in the colored race, ten occurred in males, and seven in females, during middle life.

Etiology. The part played by *heredity* as a predisposing cause of cancer has not yet been definitely established, though it is now more generally believed that this factor plays but a subordinate rôle.

The following tables, abstracted from our 1000 cases of cancer of the stomach, are interesting in this regard.

An hereditary history of cancer appearing in various portions of the body occurred in 104 of the 1000 cases (9.4 per cent.). Of these there were:

	Cases
With a family history of cancer of the stomach	22
" " " " " " " " uterus	37
" " " " " " " " breast	24
" " " " " " " " throat	5
" " " " " " " " rectum	11
" " " " " " " " face	5
Total	104

The following table indicates the ages of the cases presenting a family history of cancer, showing that the largest proportion of cases occur in those years in which the greatest number of cases of cancer of the stomach occur—that is, in middle life:

Age	Cases	Cases with family history of cancer
20 to 30	4	3
30 " 40	37	33
40 " 50	261	44
50 " 60	395	22
60 " 70	218	5
70 " 80	85	
Total	1000	104

Trauma has been noted as a cause of cancer of the stomach. Osler reports but one case, while Coley refers to a number of instances. In our cases a history of trauma was elicited in nineteen, in six of which there had been blows on the abdomen.

Previous disorders of digestion bear a definite relation to this disease.

In the 1000 cases of cancer there was a history of some previous digestive trouble in 232 cases (23.2 per cent). Of the 232 cases, 109 had slight attacks of indigestion for a period of five years or more preceding the present gastric disease, while twenty-five had slight attacks only during the last five years preceding the present disease. Of the remaining 123 cases, thirty-two had chronic indigestion more or less all their lives, of which twenty-nine had chronic indigestion mainly during the last five years preceding the present illness. Seventy-three cases gave a definite history of former gastric ulcer. It is therefore evident that of these 1000 cases, but twenty-three per cent. presented a history of any previous digestive disturbance whatever, even in the slightest degree, and that but 7.3 per cent. gave a direct history of ulcer. If, therefore, all of the former digestive disturbances be considered as due to ulcer, the formation of gastric cancer from ulcer could not have taken place in more than twenty-three per cent.; if all of these cases with slight digestive disturbances be disregarded in our series, this percentage is reduced even to 12.3 per cent. Wilson has concluded that practically all carcinomata develop on the site of a previous ulcerative lesion of the gastric mucosa, though this is not in accord with our clinical experience.

Some clinicians consider chronic inflammations of the mucosa as predisposing factors in the production of cancer, especially when present in the polypoid form. Finney and Friedenwald have reported three cases of gastric polyposis with carcinomatous degeneration. Excesses in food and drink have an etiological bearing on this affection. A history of former indiscretions in diet was obtained in 32.1 per cent. of our cases, but only in 13.7 per cent. did the patient attribute his disease to some specific error in diet. A history of alcoholism was obtained in 15.2 per cent. of our cases.

Infectious Diseases. A history of syphilis was obtained in seventy-nine instances; tuberculosis of the lungs was present in forty-eight instances.

Cardiovascular Changes. Chronic endocarditis was present in 11.4 per cent., arteriosclerosis being observed in 69.6 per cent. of all cases, as may be noted in the following table:

Age	Cases	Cases with arteriosclerosis	Per cent. of cases with arteriosclerosis
20 to 30	4	0	0
30 " 40	37	0	0
40 " 50	261	89	12.7
50 " 60	396	321	46.1
60 " 70	218	201	28.7
70 " 80	85	85	12.5

Pathology. Cancer of the stomach originates in the glandular structure of the mucosa and consists of an atypical proliferation of the glandular epithelium. It soon infiltrates the submucous, muscular and serous coats and extends into the lymphatic glands which become enlarged. The growth has a tendency to ulcerate, sometimes deeply and at other times superficially, and at times involves the blood-vessels, causing hemorrhage. As the disease progresses metastatic nodules appear in the liver, omentum and other organs. Metastases were noted in 672 (67.2 per cent.) of our cases, distributed as follows:

255 (37.9 per cent.)	occurred in the glands.
222 (33.0 per cent.)	" " " liver.
54 (8.0 per cent.)	" " " peritoneum.
45 (6.6 per cent.)	" " " pancreas
41 (6.1 per cent.)	" " " intestines.
14 (2.0 per cent.)	" " " lung.
12 (1.7 per cent.)	" " " spine.
2 (0.3 per cent.)	" " " skin.
27 (4.0 per cent.)	undetermined.

It is evident that over seventy per cent. of the metastases appeared in the glands and in the liver.

Location of the Growth. Cancer of the stomach is most frequently located in the pyloric region. According to Welch, of his 1300 cases, 791 were at the pyloric area, 148 on the

lesser curvature, 104 at the cardia, 68 on the posterior wall, 61 involved the greater part of the stomach, 45 were multiple tumors, 34 were found on the greater curvature, 38 on the anterior wall and 19 on the fundus. According to our observations in 284 cases determined at operation or autopsy, the location of the growth was as follows:

	Number	Per cent.
In the pyloric area	166	58.4
" " cardiac "	19	6.6
" " lesser curvature	23	8.1
" " greater "	12	4.2
" " fundus	8	2.8
General involvement	56	19.7

The most common forms of cancer of the stomach are: I. Scirrhus. II, Adeno-carcinoma. III, Medullary. IV, Colloid.

I. *In scirrhus carcinoma* one observes large amounts of connective tissue, producing a firmness in the growth which at times is almost cartilaginous in character and on section presents a pearly or yellowish appearance. This growth has but a slight tendency to ulcerate except late in the course of disease; it is slowly progressive, metastases being infrequent. This growth is most frequently noted at the pylorus and on account of the contraction of the fibrous tissue is apt to produce stenosis. When this tumor is diffuse and involves a large portion of the stomach it is apt to lead to the condition known as linitis plastica.

II. *Adeno-carcinoma* of the stomach occurs, as a rule, in the form of soft tumors of the polypoid type. It is most commonly found near the pylorus and eventually ulcerates.

III. *Medullary carcinoma* consists of soft spongy tumorous masses involving all of the coats of the stomach, forming cauliflower-like projections into the mucous membrane. As a rule it metastasizes early, and ulcerations and hemorrhage are not infrequent.

IV. *Colloid Carcinoma*. This form of cancer is formed from a colloid degeneration of the cells of a malignant growth in the stomach. It invades all of the coats of the stomach and metastases are frequent.

Carcinoma of the stomach is usually primary, though secondary growths have been noted in the stomach. In our series secondary cancer of the stomach occurred in 0.9 per cent. Three were secondary to breast cancers, two to rectal cancers, and four to uterine cancers.

Complications. Among the complications which may arise as a result of carcinoma of the stomach are: dilatation of the stomach due to pyloric stenosis; adhesions to neighboring organs; perforation; hemorrhage; and subphrenic abscess. In our series of 1000 cases, dilatation of the stomach occurred in forty-six per cent., the largest number being noted between the fiftieth and sixtieth years.

Symptoms. The recognition of carcinoma of the stomach is exceedingly difficult in its early states. For it is a well recognized fact that the earlier the stage of the growth, the less positive are its manifestations. If one analyzes a series of cases of cancer of the stomach, one finds that the patients developing this affection are not as a rule chronic dyspeptics, and, excepting in those instances in which the disease has developed from a previous gastric ulcer, have usually been in good health with a normal digestion until the onset of this disorder.

This fact is well illustrated in the 1000 cases of cancer of our own, in which there was a history of some previous digestive trouble in but 232 cases (23.2 per cent.). Of the 232 cases, 109 had slight attacks of indigestion for a period of five years or more preceding the present gastric disease, while 25 had slight attacks only during the five years preceding the present disease. Of the remaining 123 cases, 32 had chronic indigestion more or less all their lives, of which 29 had chronic indigestion mainly during the five years preceding the present illness. Twenty-three cases gave a definite history of former gastric ulcer. It is, therefore, evident that of these 1000 cases, but 23 per cent. presented histories of previous digestive disturbances, even in the slightest degree, and that but 7.3 per cent. gave direct histories of ulcer, while in 77 per cent. of the cases the onset was sudden and acute. The fact that the onset of this affection is sudden in a large proportion of cases is a sign of great value in the early diagnosis of this disorder.

In our endeavor to arrive at an early diagnosis, the most important signs and symptoms must be taken into consideration. Of these the following are most characteristic:

Loss of flesh.

Pain.

Anorexia.

Vomiting.

Dysphagia.

Hematemesis.

Melena and the presence of occult blood in the stools.

The presence of a palpable tumor.

Dilatation of the stomach.

Ascites and edema of the extremities.

Changes in the gastric secretion.

Certain roentgenological findings.

Loss of Flesh. Loss of flesh is a sign of very considerable importance. It occurred in 98.5 per cent. of our cases, in which there was a loss of flesh of from five to seventy-eight pounds. We have observed, however, that thirty per cent. of our cases presented periods of improvement in weight and in general conditions, with an increase in flesh of from five to twenty-five pounds. These periods of improvement occurred, in the greatest number of cases, from one or two months (that is, in seventy-nine per cent. of all cases) after the beginning of treatment. While, therefore, loss of flesh is a sign of importance as an early sign of cancer, periods of improvement with gain of flesh are not uncommon in the early period of this disease, and this should be kept in mind in the diagnosis of gastric cancer.

Pain. Of our cases, pain was present in 93.1 per cent.; in 56 per cent. of these cases pain extended more or less over the entire abdomen; it was limited to the epigastric region in 22.9 per cent.; in 68 per cent. to the lower abdomen; in 6.2 per cent. to the back, and in 1.1 per cent. to the chest. It was present as an early sign in 84 per cent. of our cases, but because of its variation as to location and extent, its diagnostic value as an early sign of gastric cancer is lessened.

Anorexia. Anorexia is a very prominent symptom of gastric cancer, and was present in over 89 per cent. of our cases. It varies markedly from a slight loss of appetite to an abso-

lute aversion to food. It was slight in 23 per cent. of our cases, moderate in 30 per cent., and variable in 7 per cent. It is usually a very early symptom, but is present in so many other affections that, unless taken in connection with other signs, is of but little significance. The aversion for meat, which frequently occurs early in the disease, is of diagnostic importance.

Vomiting. Vomiting is also of frequent occurrence in gastric cancer, appearing in 89 per cent. of our cases, in 67 per cent. of which it was in no way associated with the ingestion of food. This symptom is exceedingly frequent, but presents such slight relationship to food that it can be accorded only minor importance in diagnosis.

Dysphagia. Dysphagia existed in 6.9 per cent. of our cases; that is, in those instances in which the growth involved the cardiac orifice. It appeared as an early sign in 78 per cent. of these cases, and according to our experience, when manifesting itself in patients over forty years of age, is a sign of great significance.

Hematemesis. Gastric hemorrhage occurred in 22.7 per cent. of our carcinoma cases, of which 88.7 per cent. were multiple and 10.8 per cent. single hemorrhages. It appeared as an early sign in 21 per cent. of these cases, and as a late sign in 79 per cent. The hemorrhages were small in 66.5 per cent., profuse in 27.3 per cent. and variable in 6.1 per cent. of these cases. It was coffee-ground in 88.9 per cent. of all the cases with hemorrhage, bright red in 7.9 per cent. and variable in 3.1 per cent. Inasmuch as gastric hemorrhage appears early in only a small proportion of cases, it can only rarely be relied upon as an early sign of this disease, but when it occurs, especially in the coffee-ground form, it presents additional evidence in the diagnosis.

Melena. Tar-colored stools appeared in 18.9 per cent. of our cases, much less frequent than hematemesis, but in only a small proportion of these cases did it appear as an early sign (that is, in 14 per cent.), while it appeared late in 86 per cent.

The stools were examined for occult blood in 642 of our 1000 cases. A positive reaction was obtained in 92.5 per cent. When occult blood is once observed, it can usually be found

at any time afterward. Of the 642 cases, 216 were early cases. Of these, 93 per cent. presented occult blood, indicating that the presence of occult blood is a very constant as well as an early sign of gastric cancer.

Presence of Palpable Tumor. While the presence of a palpable tumor is the most valuable diagnostic sign of gastric cancer, yet this sign is usually a late manifestation of the disease. According to our observations, in only 30 per cent. of our cases could a mass be palpated within six months after the first appearance of symptoms, while in 70 per cent. it was present only after six months, from which it is evident that the appearance of a palpable mass is over twice as common after the first six months after the first appearance of symptoms than before that period, and cannot, therefore, be relied on as an early sign of this affection.

Dilatation of the Stomach. Dilatation of the stomach due to pyloric stenosis occurred in 47 per cent. of our cases, and this condition, when present early, is of the greatest diagnostic value. It occurred as an early sign in 52 per cent. of our cases of gastric cancer. As Baetjer and Friedenwald have pointed out recently in a paper "On the Diagnosis of Incomplete Forms of Pyloric Stenosis by Means of the X-ray," beginning obstructions of the pylorus occur early as partial obstructions, which gradually increase in degree until complete stenosis is produced. Partial obstructions often begin early in the course of the disease, and can usually be easily recognized by means of roentgen ray examinations. Partial stenosis, when ulceration can be excluded, is of the greatest significance in the early diagnosis of cancer.

Ascites and Edema of the Extremities. Ascites or edema appeared in 21.1 per cent. of our cases. Ascites appeared alone without edema in 4.4 per cent.; edema appeared without ascites in 10.4 per cent.; edema and ascites appeared together in 6.3 per cent. Of the 211 cases with ascites or edema, but 24.6 per cent. presented these signs before the first six months after the appearance of symptoms, while 74.7 per cent. presented these signs after the first six months, indicating that both ascites and edema are late manifestations in gastric cancer.

Changes in the Gastric Secretion. In 89 per cent. of our cases there was an absence of free hydrochloric acid. The absence of free hydrochloric acid is an early sign in many instances, appearing in 81 per cent. of our early cases, and when taken in conjunction with other symptoms, is a sign of real importance; and yet an absence of hydrochloric acid is so frequently observed in affections other than cancer that this sign loses much of its significance. In this connection it must not be forgotten that after the fiftieth year of age there is a natural tendency to a diminution in the gastric secretion, and that it is not uncommon to observe this condition as a manifestation of middle life. There should not be too much stress, therefore, placed upon this finding as an evidence of cancer.

Lactic acid was present in 82 per cent. of our cases. It was present only in any appreciable amount in those instances in which there was a complete absence of free hydrochloric acid. It appeared as an early sign in 76 per cent. of our cases. The diagnosis of cancer is greatly strengthened when, in the absence of free hydrochloric acid, lactic acid is found.

The Oppler-Boas bacilli were observed in 79 per cent. of our cases. They were found only in those instances in which lactic acid was observed, and appeared as an early sign in 74 per cent. This finding when accompanied by the presence of lactic acid and an absence of free hydrochloric acid, is a sign of great diagnostic importance.

We have utilized the Wolff-Junghans test in 106 of our cases of gastric cancer. In all of these cases there was an absence of free hydrochloric acid. According to the observations of Wolff and Junghans, the gastric contents in cancer present large quantities of soluble albumin, while in non-malignant achylia but little albumin is obtained. By means of simple dilutions of the contents, and precipitating the soluble albumin by means of a phosphotungstic hydrochloric acid mixture, the variations in this reaction can readily be observed.

In 89 cases (83.9 per cent.) there was a positive reaction obtained. Of these, 18 were early cases, and the reaction was positive in 13 (72.2 per cent.). This test is an extremely

valuable sign when positive in the early diagnosis of gastric cancer, especially when there is an absence of free hydrochloric acid, and when lactic acid is present in the gastric contents.

Certain Roentgenological Findings. The roentgen ray examinations have been of great help in many instances in the diagnosis of gastric cancer. Inasmuch as the largest proportion of cancers have their seat at or around the pylorus, early obstruction is not infrequent. In the early stages of this disease, as we have already pointed out, the obstruction is incomplete, and it is only by means of the x-ray that beginning or partial obstructions of the stomach can be determined. In the early stages of this condition we have active contractions of the stomach, with a slow elimination of the stomach contents. Another very significant sign is the fact that we frequently observe that a portion of the stomach just within the pylorus, on the greater curvature in the pyloric region, shows a tendency to bulge. This condition is produced by the active contractions of the stomach forcing all of the food towards the pyloric region. The pylorus not being patent, the prepyloric region becomes dilated under this constant pressure, so that the plates present the pylorus not at the end of the stomach, as it were, but the prepyloric region extends farther to the right than the pylorus, the pylorus resting on the top of the stomach and pointing to the splenic region. The prepyloric bulging is dependent largely upon the duration of the affection. In the early stages it is very small, but, as the condition advances, the prepyloric bulging may reach the size of a hen's egg. As the condition advances, dilatation begins to take place, and after a time practically the entire fundus yields, so that a typical sac-like formation is produced, and the entire bismuth rests in the bottom of the fundus. In this state the examination will present a retention of contents of from ten to twenty hours.

The most important x-ray evidence, however, of cancer is a filling defect, which remains constant in all of the plates. When the disease has been present for some time (that is, in advanced cases) the defect is large and very irregular, and there is an absence of peristalsis at this area. In the early cases, however, there is but a slight thickening at the cancer

area with weakened peristalsis, which frequently makes the diagnosis exceedingly doubtful or even at times impossible.

While, therefore, the roentgen ray examination is exceedingly useful and presents important aid in the diagnosis of gastric cancer, it is of value only in certain instances in the early stages.

Special Tests. The only special tests that need here be considered are: 1, Abderhalden's serum test, and 2, the blood-sugar tolerance test.

1. *Abderhalden's Serum Test.* Dr. Charles E. Simon has tested this reaction in a number of our cases of gastric carcinoma, and finds that the reaction cannot be considered specific for this disease. This cannot be explained on the basis of faulty technique, as the utmost care was taken in carrying out the test. It may be due to the fact that we are dealing with various cellular types in carcinoma, and that, for instance, a serum from a patient affected with a squamous-celled carcinoma may not react to the serum of one affected with a cylindrical-celled carcinoma. Fulchiero found that in thirty-six cases of carcinoma there was a positive reaction in only twenty-one (that is, in sixty per cent.), and that in forty-five serum controls in cases of various kinds (not cancer) there was a positive reaction in five cases (12.1 per cent.). This indicates that there may be a variation in two directions, as there may be failure to get the reaction in undoubted cases of malignancy, and on the other hand, there may be obtained a positive result in conditions which are not malignant.

II. *Blood-Sugar Tolerance Test.* Friedenwald and Grove have described this test as rather characteristic of carcinoma of the stomach and intestines, providing diabetes, nephritis, tuberculosis and thyroid disturbances can be excluded. In cancer of the stomach this curve presents a high sugar content even in the fasting state, followed by an initial rise up to 0.24 per cent. or even higher within forty-five minutes after the ingestion of the dextrose, remaining at this level or higher for at least two hours, and at no time falling below 0.20 per cent.

In drawing our final conclusions concerning the significance of the various signs and symptoms of gastric can-

cer, it is quite evident that many are general manifestations frequently present in other gastric affections, and not characteristic of this condition alone, while those which are more characteristic are usually late developments. On this account the late diagnosis of cancer is rendered exceedingly simple while, on the other hand, the early diagnosis is exceedingly difficult.

In reaching definite conclusions it is therefore important to rely not upon a single sign or symptom, for there are no pathognomonic signs of early cancer, and only after a critical review of the history, physical examination, and study of the symptoms, including examination of the gastric contents and stools, can definite conclusions be drawn. We take into the consideration, in our diagnosis, the age of the patient, the history of the affection (that it, its onset in the midst of good health), the anorexia, vomiting, pain, hematemesis, loss of flesh and strength, and early dilatation of the stomach. In addition, we have the evidences afforded by the examination of the gastric contents; that is, the absence of free hydrochloric acid, and the presence of lactic acid, Oppler-Boas bacilli and blood.

A positive Wolff-Junghans reaction, manifestations of gastric retention, and the persistence of occult blood in the stools, are evidences of additional value. But we rarely have all of these signs present in early cancer, and usually there are so few that the diagnosis is impossible.

It is most important, too, to remember that gastric cancer usually appears at the age in which arteriosclerotic changes have already manifested themselves, on account of which there are retrogressive changes and impaired metabolism with loss of strength, with symptoms often akin to those of cancer. There is at this period of life, as we have observed some years ago, a tendency even to a diminution of the gastric secretion with an absence of free hydrochloric acid, and this, too, may further complicate the diagnosis. Further difficulties often arise by the occurrence of gastric cancer in patients suffering with some preceding affection, such as diabetes, chronic Bright's disease, cardiac affections, and chronic infections, on account of which there are often marked emaciation, loss of strength, and indigestion; the presence of a

carcinoma may, therefore, easily be entirely overlooked. Finally, there still remains another group of cases, known as latent cancers, in which symptoms are not revealed until late in the course of the disease, and, at times, not at all.

Inasmuch as surgery offers the only cure for gastric cancer, and then only when the diagnosis is made early, the question of early diagnosis is of the greatest importance. How can this be made?

As yet it is impossible to reach very definite conclusions at the early stage, except in rare instances. But it behooves us to carefully observe all of our cases of gastric disturbances most critically, and to view with suspicion all patients over forty years of age who show no improvement after a short course of medical treatment.

Inasmuch, therefore, as our means of early diagnosis of cancer of the stomach are exceedingly insufficient, and until more certain methods of diagnosis are available, exploratory incisions should be urged upon all individuals over forty years of age having gastric symptoms which are not relieved after a few weeks of treatment. Especially is this the case if the patient presents a history of rather abrupt onset, some loss of flesh, an absence of free hydrochloric acid in the gastric contents, and occult blood in the stools.

Even under these conditions many cases will be operated on too late, for there can be no question but that gastric cancer may be present for some time and may assume considerable proportions even before marked symptoms of indigestion are manifested.

Differential Diagnosis. In the differential diagnosis the following conditions must be taken into consideration which are also apt to occur in middle life. Of these we have grave anemias of the pernicious type, syphilis, cirrhosis of the liver, ulcer of the stomach, and achylia gastrica; and occasionally some form of nervous gastric affection.

Treatment. The treatment of cancer of the stomach is surgical, but unless the diagnosis is made early the results of surgery are most disappointing, rarely accomplishing more than relief and never cure. Of the entire number of our cases, operations were performed in two hundred and sixty-six instances. Of these, fifty-one per cent. were exploratory.

Gastroenterostomies were performed in thirty-six per cent.; gastrostomies in seven per cent., and pylorectomies and gastrectomies in three per cent. Thus far the results have not been encouraging. In the further treatment of this disease internal treatment is only palliative, in which diet plays an important rôle. Food should be given in small quantities, should be very nutritious and easily assimilated. When there is obstruction either at the cardia or pylorus, the food should be either liquid or semisolid. Of the liquid foods, milk, buttermilk, koumiss, and broths, are to be recommended. Fruit juices, vegetable juices, and eggs, are also useful in this disease. Fat should be given in the form of butter and olive oil. Meat, which is usually distasteful to these patients, can be prescribed scraped or given as meat jelly. Vegetables must be taken in purée form, and bread should be thoroughly toasted or taken as zwieback. Inasmuch as this disease is incurable, too great a restriction should not be placed upon the diet and monotony should be avoided. In the further treatment of the patient, lavage is of great value, especially if there be a motor insufficiency at hand. The use of drugs in this affection is purely palliative, inasmuch as no remedy is known that can exert the slightest beneficial affect upon the course of the disease. Codein and morphin must be prescribed for pain, and bitter tonics may be given as stomachics.

DILATATION OF THE STOMACH.

In dilatation of the stomach there is always present a marked motor insufficiency; a motor insufficiency of a less degree producing atony. We, therefore, distinguish between motor insufficiency of the first degree (atony) and motor insufficiency of the second degree (dilatation). Both of these conditions are important factors in the study of diseases of middle life. Atony is characterized by relaxation of the muscular wall of the stomach and has been variously classified; and will be discussed further on under the gastric affections of the sympatheticotonic group.

In dilatation of the stomach we recognize a chronic state in which the stomach is no longer able to expel its contents, in consequence of which there is a stagnation of food.

Etiology. Dilatation of the stomach may be due to one of two causes. Either atony, which by becoming more aggravated, is gradually transformed into this condition, or to stenosis of the pylorus. It is rare, however, to observe dilatation due to atony. The main conditions leading to dilatation are: the cicatrization of gastric ulcers, the contraction of cicatricial tissue from cholecystitis or following operations on the gall-bladder, and the occlusion of the pylorus by carcinoma. Other but less important factors are: the formation of polypi at the pylorus, hypertrophy of the muscles surrounding the pylorus in certain forms of chronic gastritis, long continued pylorospasm, and pressure from abdominal growths.

In our series of the five hundred cases of middle life, dilatation occurred in thirty-five instances. Fourteen of these were due to ulcer, and twenty-one to cancer. The following table illustrates our cases of dilatation due to ulcer and cancer, arranged according to age and sex:

Years	Number of males		Number of females	
	Ulcer	Cancer	Ulcer	Cancer
40 to 45	4	1	3	1
45 to 50	2	3	1	2
50 to 55	2	8	2	6

Symptoms. The symptoms first manifested are, distention, fullness and pressure, which finally give rise to pain; the pain being due to the attempt of the stomach to empty itself and overcome the obstruction. Finally symptoms of stagnation occur, which are manifested by the vomiting of large quantities containing the remains of food eaten on a previous day. The vomitus is of the well known three-layer variety. On standing in a glass it separates into a lower layer of solid particles, with a middle layer which is fluid and cloudy, and a top layer containing mucus filled with gas bubbles. On microscopic examination of the fluid, sarcinæ and yeast spores are present in abundance. In the vomitus associated with the stenosis produced by cancer, the material is thick, contains a great quantity of mucus and is much decomposed. As the

disease progresses the thirst becomes intense, the urine is diminished and constipation is marked. The appetite gradually diminishes and emaciation may become extreme. These patients are much weakened and complain of dizziness, lassitude, and headaches. The diagnosis is definitely determined by the symptoms already noted, by the visible peristaltic movements and x-ray signs of stenosis, which are extremely definite presenting at least a twelve to eighteen hour retention. The examination of the gastric contents reveals food remains of the previous day, and the characteristic three layered contents. In non-malignant stenosis the gastric contents is acid due to HCl and organic acids, and sulphuretted hydrogen is frequently present. In stenosis due to carcinoma HCl is usually absent, but the presence of lactic acid and Oppler-Boas bacilli are important aids in diagnosis.

Treatment. The treatment of this affection is mainly surgical, though at times when taken early this condition may be overcome by medical means. Diet plays an important rôle in treatment. This should consist largely of semisolids and should be given in small quantities at frequent intervals. Proteins should be prescribed in the form of chicken, chops, or beef, but only in the minced or scraped forms. Green vegetables must be given in the purée form and carbohydrates only in small amounts. Liquids should be restricted in amount as far as possible, best given as milk. Cohnheim has advised the administration of olive oil in these cases. In order to allay the thirst, bits of crushed ice may be allowed and water given by rectum. In those instances in which food is constantly vomited, rectal alimentation in the form of the drip method, with glucose, should be practised. Much relief is often obtained by means of lavage, or perhaps better still, by expressing a portion of the contents of the stomach at times, according to the recent method advised by Boas. The use of drugs is of but little value in this condition. In malignant forms with the absence of free HCl, dilute hydrochloric acid should be administered with pepsin. In the non-malignant forms, alkalies with atropin are indicated. In all well defined cases of stenosis of the pylorus with stagnation, operation is indicated. In stenosis due to ulcer, our most favorable results have been obtained by means of Finney's

pyloroplasty and when this cannot be practised gastroenterostomy or perhaps pylorectomy should be done. In stenosis due to carcinoma the most favorable results are obtained by means of pylorectomy. At times gastroenterostomy is the only means open for relief.

There is a complication which at times is associated with gastric dilatation known as tetany, to which attention must be drawn. This condition is characterized by paroxysmal or constant bilateral tonic spasm of the extremities. In all of these cases operation is indicated. Moynihan reports fourteen cases in which gastroenterostomy was performed, with cure.

Acute Dilatation of the Stomach. Acute dilatation of the stomach is an extremely serious affection, noted especially after abdominal operations, trauma, dietetic errors, and toxemias from infections, as in pneumonia or typhoid. The characteristic feature is an enormous distention of the stomach, merging into the paralytic state. This affection is often the first stage of an arteriomesenteric ileus. The symptoms of this condition are, pain of an intermittent type, continuous vomiting, difficulty in obtaining bowel movements, and signs of collapse. In the treatment of this affection lavage plays an important rôle. This is best accomplished by allowing the Einhorn tube to remain continuously in the stomach and washing constantly. No food should be administered by mouth and pituitrin should be given hypodermically in an attempt to reëstablish normal peristalsis. Frequent rectal irrigations are indicated.

GASTROPTOSIS.

Gastroptosis, a displacement of the stomach extremely common in middle life, is usually complicated with a similar condition of the intestine and other abdominal organs. It is also frequently associated with other abdominal affections, at times exerting evident influence upon the symptomatology of such disturbances. We have only included here those cases of gastroptosis of middle life in which the symptoms manifested were almost entirely due to this affection.

There are two types of gastroptosis: the congenital and acquired forms. In the congenital form, the prolapse is due

to an inherited constitutional weakness. It is quite possible that the endocrine glands may exert some influence in this regard. In the production of the acquired form mechanical factors play an important rôle; of these, childbirth, trauma, tight-lacing, and overexertion, are especially to be mentioned.

Etiology. Due to the relaxation of the ligaments and mesenteric attachments or to the disturbed intra-abdominal pressure, producing a loss of tone of the abdominal muscles, varying degrees of prolapse may ensue.

Gastroptosis is most commonly observed in middle life, although it may occur at a much earlier period. It is far more common in females than males. In our study of the five hundred cases of diseases of the stomach in middle life, this affection occurred in sixty-nine instances (13.8 per cent.). The following table presents our cases arranged according to age and sex:

Ages in years	Male	Female
40 to 45	9	16
45 " 50	10	12
50 " 55	8	14
Total	27	42

Attention must be called to postural defects in their bearing on ptosis. According to the observations of Goldthwaite, Bryant, Mandell and Koenig, posture is of the greatest importance, both as a cause as well as a means in the correction of this affection.

Symptoms. In many individuals affected with this condition, no annoying symptoms are noted. On the other hand, it not infrequently occurs that the symptoms accompanying a gastroptosis are relieved without a correction of the displacement. In many instances patients are affected with lassitude, fatigue, headache, general malaise, loss of flesh and with frequent disturbances of the circulation, the pulse rate increasing when the patient is in a standing posture. Gastric distress is often present in the form of fullness, nausea, eructations and occasionally pain. The appetite is variable and symptoms of hyperacidity are at times observed. Constipation is a very frequent manifestation and backache is not uncommon. Associated with the constipation mucous-colitis

often occurs. The gastric secretion presents a variable degree of acidity, though according to our experience subacidity is most frequent.

In our sixty-nine cases the acidities were as follows:

Normal acidity	22
Hyperacidity	16
Subacidity and anacidity	31
Total	69

Diagnosis. The characteristic appearance of the patient—the habitus enteroptoticus—is well known. The thorax presents a narrow and elongated appearance and the abdomen reveals a distention of the lower part in the upright position, which usually disappears when the patient is in the reclining posture. The well known “Stiller sign”—the movable tenth rib—is present in a large proportion of cases. The position of the stomach can usually be located by means of auscultatory percussion or inflation of the stomach, but the x-ray presents the most accurate method of determining the location as well as motility of this organ.

Aaron has presented us with a valuable sign of the presence of gastropptosis. The pain occasioned by deep pressure over the celiac plexus is relieved when the patient’s abdomen is elevated by passing both arms about him and elevating the abdomen.

Treatment. While the possibility of a permanent replacement of the stomach is not particularly favorable, the symptoms occasioned thereby may be greatly relieved and at times entirely overcome by appropriate treatment. As prophylactic measures in the prevention of this disorder, care should be taken in having patients remain in bed sufficiently long after childbirth and in the adjusting of a proper abdominal support, and by strengthening the abdominal muscles by massage and proper exercise in individuals prone to this affection. In the general treatment of these patients attention should be especially directed to improving their general nutrition and strengthening of the muscles of the abdomen.

Of primary importance is the care in diet. In this regard the state of the gastric secretion affords the best guide. Inas-

much as many of these patients are undernourished, forced feeding may become necessary.

This is best accomplished by placing the patient in bed, the foot of the bed being elevated.

A rest cure of this form may require four to six weeks to bring about satisfactory results. In other patients whose physical condition is not in need of a rest treatment, physical training, together with the adjusting of a properly fitting abdominal bandage may be all that is required.

Hydrotherapy and abdominal massage are usually extremely beneficial adjuvants in the treatment of this affection. The constipation which is usually a marked feature of this condition, is often greatly relieved by the measures already noted. Purgatives as far as possible should be avoided. The regulation of the bowels can usually be brought about by means of such simple remedies as mineral oil and agar-agar.

In the treatment of the mucous-colitis so frequently associated with this condition, the use of high oil enemata is to be recommended. The general nutrition of the patient can be often improved by means of the hypodermic injections of cacodylate of soda and iron.

SYPHILIS.

Gastric syphilis is a rather rare affection, though it appears most frequently in middle life. According to Mills, one case occurs in every one hundred cases of gastric organic lesions of all sorts, and in our five hundred cases of gastric disturbances of middle life, it appears in ten instances (two per cent.). It occurs much more frequently in males than females. The following table presents our cases arranged according to age and sex:

Ages in years	Male	Female
40 to 45	1	0
45 " 50	3	2
50 " 55	4	0
	<hr/>	<hr/>
Total	8	2

In the largest proportion of instances the cases have occurred during the tertiary stage of the disease, though secon-

dary syphilis is frequently accompanied by symptoms of indigestion due, as a rule, to a toxemic gastritis.

Pathology. The various gastric lesions appearing in tertiary syphilis have already been described, pages 9 to 11. These appear as (1) large gummatous formations; (2) in the form of endarteritis, and (3) as chronic inflammation of the gastric mucosa. There is a tendency to terminal contractural cicatrization in syphilitic disease of the stomach which results either in hour-glass formation or general contraction of the stomach.

Symptoms. Clinically syphilis of the stomach may be classified according to Einhorn, into three groups: (1) Luetic ulceration of the stomach, (2) syphilitic tumor, and (3) luetic stenosis of the pylorus.

1. The syphilitic ulcer is the most frequent form of gastric lues. It may arise as a result of endarteritis causing a necrosis of a circumscribed area of the stomach or as the result of the destruction of a gumma. The pain which occurs in this condition is much like that of gastric ulcer, though relief is not so frequently afforded by food and alkalies. It appears usually immediately following meals and is relieved by vomiting. Hemorrhage is not frequent in this affection and the appetite remains good. Great loss in flesh is usual.

2. Specific tumor is manifested by a mass in the gastric area in a syphilitic subject. This is accompanied by pain, vomiting and loss of flesh, and gives rise to the suspicion of carcinoma.

3. In specific stenosis of the pylorus, pain, nausea and vomiting are prominent symptoms. The vomiting is of the retention type and emaciation is rapid.

Diagnosis. The Wassermann reaction is positive in most instances and in doubtful cases a provocative test is always indicated. The gastric secretion usually presents an achylia, even in instances of luetic ulceration. Achylia was present in all our cases.

Roentgen ray evidence is of great importance in diagnosis. According to Mills the salient x-ray features are: "First, that of a general but locally accentuated contour defect; second, a general diminution in area of the gastric shadow; third, that of motor impairment of either the obstructive or

more usually the residual type; and fourth, though less important, atypical peristalsis."

Syphilis of the stomach must be distinguished from carcinoma and the crises of locomotor ataxia.

Treatment. The prognosis is quite favorable providing the treatment be undertaken reasonably early. Where hour-glass contraction or stenosis of the pylorus has occurred, surgery is indicated. Under all conditions thorough anti-syphilitic treatment should be undertaken in all cases.

SECONDARY GASTRIC AFFECTIONS.

Attention has already been directed to the very frequent occurrence of the disturbances of the functions of the stomach in diseases of other organs. In youth such affections are rather unusual, but as individuals advance in years the incidence gradually increases, so that even in middle life they comprise the largest proportion of gastric disturbances of that period. In the study of our five hundred cases of the gastric affections of middle life, the secondary disturbances number ninety-nine (19.8 per cent), occurring more frequently in males than females.

The following table presents our cases arranged according to age and sex:

Ages in years	Male	Female
40 to 45	10	13
45 " 50	19	12
50 " 55	26	19
Total	55	44

The cause of these secondary gastric affections lies, as we have already pointed out, either in some disturbance of the circulation, nervous system, or is due to toxemia. The diseases in which disturbances of the gastric functions are particularly conspicuous during middle life are tabulated as follows, together with their incidence in our ninety-nine cases:

Acute febrile diseases	4
Diseases of the intestines	11
Diseases of the liver and gall-bladder	13
Diseases of the pancreas	4
Diseases of the kidneys	20
Diseases of the heart and blood system	22
Diseases of the lungs	17
Diseases of metabolism	5
Diseases of the nervous system	3

Functions of the Stomach in Acute Febrile Diseases. The gastric disturbances in acute febrile diseases, such as typhoid and pneumonia, are accompanied by diminution and in some instances with an absence of free HCl; there is also a weakened motor function. During convalescence an increase in secretion is again noted.

Functions of the Stomach in Diseases of the Intestines. These affections comprise largely chronic constipation, ileocolitis, intestinal obstruction, chronic appendicitis and peritonitis. There were eleven cases due to these conditions in our series.

Gastric symptoms frequently arise from chronic constipation, consisting largely of nausea, loss of appetite, distress and occasionally of vomiting. In ileocolitis and dysentery there is often present anorexia, nausea, vomiting, gastric distention and pain. In intestinal obstruction fecal vomiting, with abdominal distention, is usual. Chronic appendicitis is frequently the cause of gastric distress and in fact without discomfort in the region of the appendix itself. The gastric manifestations of chronic appendicitis are pressure, discomfort and eructations, and are largely induced reflexly by pylorospasm.

In peritonitis the symptoms of pain, nausea, vomiting and distention are too well known to require further description.

Functions of the Stomach in Diseases of the Liver and Gall-Bladder. There were thirteen cases of these affections in our series. Of these, four were due to liver disturbances and nine to gall-bladder affections. The stomach is not infrequently affected secondarily as the result of diseases of the liver and gall-bladder. Obstruction of the circulation, due to disturbances of the liver, occasions congestion of the stomach and may lead to a gradual reduction in the gastric acidity; while enlargement of the liver may displace the stomach, causing interference with its motility; again, any inflammation of the liver or gall-bladder may result in adhesions to the stomach, with consequent interference with the gastric functions. Atrophic cirrhosis of the liver is almost always associated with a chronic gastritis, often of the interstitial or glandular type, which is followed by venous congestion due to the portal obstruction, and hemorrhage

may ensue from the rupture of the varicose veins surrounding the cardia.

In cholecystitis and cholelithiasis the gastric symptoms may be so prominent as to render the diagnosis difficult; these may consist of pain, nausea, and vomiting, and the pain may be localized in the epigastrium instead of over the region of the gall-bladder. In gall-stone disease pylorospasm is frequent and the production of adhesions between the gall-bladder and pylorus often leads to interference in motility. In the early stages of gall-bladder disturbances hyperacidity is usually present—sixty per cent., with anacidity in eighteen per cent. and normal acidity in twenty-two per cent.—but as the disease advances toward middle life, anacidity is usually observed.

Functions of the Stomach in Diseases of the Pancreas. Acute pancreatitis is usually associated with gastric symptoms in the form of severe nausea, vomiting, intense pain located above the umbilicus, while in the chronic forms and in carcinoma of the pancreas there is nausea, vomiting, eructations and distress following the ingestion of food. In our series there were four cases of cancer of the pancreas, producing gastric symptoms.

Functions of the Stomach in Diseases of the Kidneys. Nephritic affections are usually accompanied by symptoms referable to the stomach. These are largely due to the toxemia produced by the renal lesion, caused by the excretion of urea and other poisons through the gastric mucosa, as well as to the cerebral irritation from the poison. When the lesion is extensive or of long duration, marked changes may take place in the gastric mucous membrane: first in the form of acute inflammation of the gastric tubules with swelling, irregularity and granular degeneration; in the later stages as a chronic inflammation of the glandular structures, the peptic cells undergoing fatty infiltration; and finally, as an inflammatory thickening of the interglandular tissue. In rare instances hemorrhage takes place in the mucous membrane of the stomach and superficial ulcers of variable size may be formed.

The character of the gastric secretion varies according to different observers. According to Biernaki, the free HCl is

diminished in proportion to the excretion of albumin, reduction in quantity of urine excreted and extent of edema. Free HCl is usually observed in the early stages but in extensive and chronic lesions of the kidneys achylia is usually noted. The pepsin and rennet ferments are always diminished and are frequently entirely absent; the motor function is usually increased.

In the early stages of chronic nephritis the gastric symptoms are often so prominent that unless careful urinary examinations be made erroneous conclusions may be reached. The gastric symptoms accompanying nephritis are: nausea, vomiting, discomfort after meals, loss of appetite, and flatulency. The vomiting in renal disease occurs immediately on arising in the morning and is associated with much retching; the vomitus consisting of mucus mixed with yellow bile and saliva. When vomiting occurs later, it may appear immediately or an hour or two after meals, and the ejected matter then contains undigested food with mucus. In uremia the vomiting takes place at frequent intervals and especially upon any attempt at nourishment; the vomited matter consisting of mucus which is bile tinged.

In obstructions to the passage of the urine due to prostatic enlargements the symptoms associated with the gastric digestion, in the form of loss of appetite, nausea, vomiting, distention and loss of flesh, are frequently so prominent that the question of gastric carcinoma cannot always be ruled out at once.

Functions of the Stomach in Diseases of the Heart and Blood System. In heart affections in which compensation is present the gastric functions are usually normal but when compensation is interfered with the portal system becomes congested, in consequence of which stasis and hyperemia of the gastric mucosa takes place. After long continued congestion of the stomach due to heart disease the mucous membrane becomes filled with hemorrhages; there is intense congestion of all of the veins and capillaries, the gastric tubules becoming irregular or compressed, and the central and parietal cells swollen. The gastric secretion in the early stages of this affection is usually normal but gradually diminishes in its acid content; the pepsin and rennet fer-

ments decrease and in advanced cases gastric motility is much impaired.

The gastric symptoms noted in cardiac disease are, distention pressure, fullness and palpitation after meals; anorexia becomes marked, and nausea and vomiting ensue. The vomitus consists of bile stained mucus, often containing traces of blood; rarely hematemesis may occur. On palpation of the abdomen the region of the stomach is found markedly distended and tender on pressure.

In pernicious anemia, anorexia, nausea and vomiting frequently occur and the gastric secretion ordinarily presents a complete achylia.

In chlorosis and secondary anemia, gastralgia, anorexia and hyperchlorhydria are usually noted.

Functions of the Stomach in Diseases of the Lungs. The disease of the lungs which sooner or later gives rise to gastric symptoms is tuberculosis. The various changes observed in the stomach in this affection are, atonic dilatation, ulceration, and the various forms of gastritis. The gastric disturbances of pulmonary tuberculosis ordinarily noted may be divided into two groups: First, the dyspepsias observed in the initial stage of the disease, and second, the dyspepsia of the final stage.

In the initial stage of the disease gastric symptoms are manifested, according to Samuel Fenwick, in eighty-three per cent. of cases, and according to Saltou Fenwick, in seventy-nine per cent.; being much more common in females than males—that is, eighty-four per cent. of females to fifty-two per cent. of males (Fenwick).

The symptoms often appear very insidiously, frequently even before the pulmonary signs have become sufficiently marked to be noted by the patient. These consist of pain or discomfort following immediately upon meals or several hours afterward; vomiting especially appearing in the early morning, preceded by cough or irritation in the throat, the vomited matter consisting of mucus from the pharynx, bronchi and stomach; loss of appetite; flatulency, and acidity. In this stage the gastric secretion is normal or hyperacidity may exist; the motor function being normal or slightly reduced.

In the terminal stage of this affection the dyspeptic symptoms are extremely marked. Of 316 cases of advanced pulmonary tuberculosis, Fenwick observed that forty-two per cent. were affected with dyspepsia. This condition is more common in females than males; sixty-two per cent. of females to twenty-five per cent. males (Fenwick).

The symptoms manifested at this stage are: anorexia, flatulency, discomfort in the epigastrium usually unaffected by the ingestion of food; nausea and vomiting frequently produced by coughing. The gastric secretion gradually shows a lessened acidity and in very advanced cases there is a true achylia; the motility of the stomach being also reduced.

Functions of the Stomach in Diseases of Metabolism; Diabetes. The digestion in diabetes is often normal. On the other hand, patients affected with this disease are liable to indigestion; chronic gastritis and atrophy of the gastric mucosa have been noted in a few instances. The gastric symptoms manifested are, bulimia, polyphagia, abdominal discomfort, distention, and eructations. Occasionally when an attack of gastritis arises, pain in the epigastrium is produced followed by nausea and vomiting. Violent pain may ensue, preceding the development of coma.

The gastric secretion in this disorder is variable, and normal, hyperacid, and achylia states may be observed. The gastric motility may be normal or hypermotility may be present.

Functions of the Stomach in Diseases of the Nervous System. Organic diseases of the brain and spinal cord are usually accompanied with gastric symptoms. In tumors of the brain, in cerebral abscess or hemorrhage, vomiting is a prominent symptom; it is usually projectile in character and preceded by headache and is in no way related to the ingestion of food; the vomitus consisting largely of hyperacid gastric secretion containing bile.

Locomotor ataxia produces gastric symptoms in the form of crises. These crises are manifested by sudden attacks of acute pain in the epigastrium, radiating into the abdomen, back, and limbs. The pain is of the girdle type and vomiting frequently occurs at the onset of the pain. The vomitus consists of the contents of the stomach and then of mucus tinged

with bile. Hypersecretion is usually present during the attacks.

The Treatment of Secondary Gastric Affections. In the treatment of secondary gastric affections, attention must be directed to the primary disorder, as in no other way can recovery be expected. It not uncommonly occurs that by the compensation of a failing heart or by the relief of a disturbed kidney function, gastric disturbances are at once overcome without further treatment. On the other hand, much can often be accomplished for the patient's comfort in these affections by direct treatment to the stomach itself. This can often be best brought about by means of diet, which must be of such a nature as to avoid over-taxing the embarrassed digestion and at the same time prevent fermentation.

NERVOUS GASTRIC AFFECTIONS.

We have already referred to the great importance of the nervous system in its relation to affections of the stomach in middle life and to the frequency of these disturbances. Of all gastric affections, fifty-five per cent. may be classified as neuroses, while forty-five per cent. represent organic disease. The gastric nervous disorders rarely have their onset in old age; they occur more frequently in youth and middle life; forty-six per cent. between the thirtieth and fiftieth years, according to Friedenwald (Osler's Modern Medicine).

Of our five hundred cases of gastric disorders of middle life, there were seventy-four cases of gastric nervous affections (14.8 per cent.). The following table presents our cases arranged according to age and sex:

Ages in years	Male	Female
40 to 45	12	15
45 " 50	10	11
50 " 55	11	15
Total	33	41

Symptoms. The symptoms of a general neurosis are usually present, that is, irritability, lassitude, insomnia, depression, and a feeling of malaise. Hyperesthesia or anesthesia often exist in certain parts of the body. The subjective symptoms are changeable and capricious, exhibiting protean

changes in rapid succession. The digestion is usually in a state of labile gastrointestinal function (Boas). The digestive complaint is frequently independent of the quantity and quality of food ingested, and frequently bears no relation whatever to meals. Periodic attacks of discomfort often alternate with unaccountable periods of well being. Frequent and sudden changes take place in the secretory or motor function of the stomach, or in both, so that a superacidity may quickly give way to a subacidity, and a motor insufficiency to a hypermotility. The pain which may be present is diffuse and often bears no relation to the ingestion of food.

Gastrointestinal neuroses are usually polysymptomatic, more rarely monosymptomatic, in character; in the first form there is a multiplicity of symptoms, while in the latter but one symptom is observed. A monosymptomatic neurosis is not infrequently converted into the polysymptomatic form.

Diagnosis. This may be very often difficult, as similar symptoms may envelop certain organic diseases, the nervous manifestations being so much more prominent that the actual disease becomes entirely masked. In order to establish the nervous character of a gastric disorder, organic affections must be excluded, which is frequently a difficult task. Functional gastric disease is frequently either characterized by peculiar periodical or paroxysmal attacks, with many unaccountable periods of well being, or by an absence of subjective symptoms, even upon the ingestion of indigestible food.

A further difficulty arises from the fact that organic disorders are often accompanied by nervous symptoms, and most careful investigation may therefore be necessary. A nervous dyspeptic himself often indicates the diagnosis of his condition, and one need only listen to his story attentively.

Objective signs may be absent or when present may be misleading. In the diagnosis of these conditions, the onset of the attacks without apparent cause and the intervals of well being are most striking. The fact that as a rule the complaints of the patient bear no relationship to the quality and quantity of food ingested, but are mainly dependent upon overtaxation, mental disturbance, and excitement, is of great value in the diagnosis. By frequently testing the motor and secretory functions of the stomach, and constantly finding

these normal, is alone sufficient evidence to indicate the neurotic nature of the disorder.

Prognosis. The prognosis of the gastric neurosis is not unfavorable provided the cause be discovered and removed and treatment be instituted promptly.

Treatment. It is necessary to remember that one is dealing with patients whose imagination is easily influenced in directions other than normal; for this reason the personal influence of the physician himself will have a great bearing on the patient's recovery. A change of scene is often imperative, and specific regulations as to the mode of living and diet should be insisted on. In some instances a rest cure in a sanitarium is most desirable.

The diet deserves particular attention, for most of these patients are undernourished and their nutrition may have to be stimulated by forced feeding. A gain in body weight is very desirable; in many instances a simplified method of increasing the patient's nutrition is to add four to eight ounces of milk to each meal and an equal amount between meals. This quantity can gradually be increased until the patient is taking ten to twelve ounces at a time, or as much as two quarts a day. Eggs may be given in increasing numbers in addition to the milk or alone when milk is not well borne. As many as one dozen eggs can be taken a day. The patient's appetite should be humored, and he should be allowed to eat any food he can digest. All stimulants should be forbidden, and the use of tobacco, tea, and coffee, is interdicted.

To aid nutrition and stimulate elimination of waste products certain physical methods of treatment are most serviceable. Of these the most important are hydrotherapy, massage, the application of stupes and electrotherapy. Cold and warm sponges, swimming, and the various forms of baths serve useful purposes. The efficacy of tepid packs, producing sleep, is well known. Gastric and duodenal lavage may be practiced, the latter yielding especially gratifying results in cases of intestinal stasis. A cure at some mineral spring is often beneficial. Massage at the beginning of treatment should be carried out gently and superficially, and only for a short time each day. Cocoa butter or olive oil and alcohol rubs are used with much benefit. Electricity is a helpful

adjuvant to treatment if used properly, and psychotherapy carefully practiced is useful. Occupational therapy may be utilized to great advantage, especially in many cases following rest cures. Such activities as book binding, weaving, knitting, etc., materially aid in bringing about relaxation and prevent introspection. The nervous dyspeptic should be taught to rely more upon hygienic measures than upon drugs, as but few drugs have any marked influence in these cases. Of the remedies that have been employed the bromides, preparations of valerian, iron, and arsenic, have been found most useful in the treatment of these affections. The hypodermic administration of the cacodylate of soda and iron are especially valuable. Following a rest treatment the patient should be encouraged to take a vacation at the seashore or the mountains.

The following classification of the functional gastric affections according to their relationship with the autonomic nervous system has been abstracted from our paper in Nelson's Loose Leaf Medicine:

VAGOTONIC GROUP.	SYMPATHETICOTONIC GROUP.
Cardiospasm	Atony
Pylorospasm	Incontinence of pylorus
Peristaltic Unrest	Acoria
Pneumatosis	Anorexia
Nervous Vomiting	Achylia gastrica
Eructatio Nervosa	Hypochlorhydria
Rumination	
Regurgitation	
Gastralgia	
Hyperesthesia	
Bulimia	
Parorexia	
Gastromyorrhea	
Hyperchlorhydria	
Gastrosuccorrhea	

While any of the various gastric neuroses may occur during middle life, only the most important will be described.

Cardiospasm.

Cardiospasm is characterized by a spasmodic contraction of the cardia, not due to organic disease. Diffuse dilatation of the esophagus frequently follows as a result of this con-

dition. This affection is observed at times accompanying neurasthenia and hysteria; it occurs after swallowing food which has not been sufficiently masticated or which has been too highly seasoned; occasionally it is produced by worry or excitement.

Symptoms. This affection may occur in two forms, either as the acute or chronic variety. The acute forms last but a few days. The attack appears suddenly and is accompanied by dysphagia, pressure and pain beneath the sternum, and a burning sensation in this region. The food accumulates in the esophagus and great effort must be exercised to force it into the stomach; when this is impossible, it is regurgitated. At times it becomes impossible to swallow any food for hours or even days; however, as soon as the food is regurgitated, relief is afforded. These acute attacks appear periodically; between the attacks the patient suffers no inconvenience. In the chronic variety dysphagia is the most prominent symptom. Great effort is required to force food into the stomach. Liquids and semisolids are most easily swallowed. After a shorter or longer period of time a diffuse dilatation of the esophagus begins to manifest itself, in which considerable quantities of food may be retained. Food is retained in the dilated esophagus and is regurgitated after a time; vomiting, however, is impossible in these cases due to the spasm. On introducing a bougie a resistance is discovered, which is more plainly felt with a large than with a small sized bougie. With gentle pressure the resistance yields and the bougie enters the stomach.

Diagnosis. The diagnosis of the acute type is arrived at by noting the varying degrees of dysphagia, by the introduction of the bougie, which passes without difficulty, by the inability of the patient to vomit, and by the absence of the second deglutition murmur. In the chronic type the dysphagia extends over a long period of time and the symptoms of dilatation of the esophagus become prominent. A large bougie enters the stomach more easily than a small one. When dilatation of the esophagus has taken place, the diagnosis may be confirmed by fluoroscopy and esophagoscopy.

Treatment. In acute forms attention should be especially directed to the nervous system, and the general health of the

patient. Large bougies should be introduced into the stomach, and should be allowed to remain for a few minutes at a time, if possible. The bromides, valerian, and belladonna, may be administered with a variable degree of success.

In the chronic forms, the diet should be restricted to liquid and semisolid food. When deglutition becomes very difficult food must be given through a tube. Large bougies should be introduced and allowed to remain in position for some time. It is necessary in these cases to produce forcible dilatation of the contracted area of the esophagus and cardia by means of special dilators.

Pylorospasm.

In pylorospasm there is a spasmodic contraction of the pylorus not due to organic disease. The etiology of this affection is, however, frequently so obscure that various theories have been suggested in explanation of its occurrence. It is a well known fact that this condition may be wholly of a nervous type, or it may be caused by some disease of the stomach, or be manifested as a reflex affection from disease of some organ either near or at some distance from the stomach itself, *i.e.*, gall-bladder, appendix, kidneys, etc.

In pylorospasm we possess another evidence of vagatonia, inasmuch as this condition can be produced experimentally by stimulation of the vagus and inhibited by stimulation of the splanchnics.

Pylorospasm occurs more frequently in females than in males.

Symptoms. Usually at the height of digestion a spastic contraction of the pylorus occurs, accompanied with moderate or intense pain, nausea, eructations, and vomiting. In the early stages, the spasm occurs occasionally but later it may become almost continuous, leading to a spastic contraction with subsequent dilatation of the stomach and retention. When this occurs, the food vomited possesses all the features that are observed in dilatation. After vomiting, great relief is afforded for from one to more days, when there is recurrence of the attack. As this disorder progresses there follows marked emaciation, loss of strength, and severe consti-

pation. During the attack the contraction of the pylorus may often be revealed by a firm protruding mass in the abdomen, which gradually disappears. The gastric secretion is usually hyperacid during the attack, but subsequently in the interval between the attacks becomes normal. Finally, the x-ray signs are usually distinctive and frequently clear up the actual cause of the spasm.

Treatment. The treatment of pylorospasm consists primarily in properly overcoming the underlying neurasthenia. On this account changes of scene, massage, electricity, or a rest cure, may be found advisable. The diet should be carefully regulated; all irritating food should be avoided. In certain instances an ulcer cure with the patient in bed for from three to four weeks under a Sippy treatment, has afforded us very satisfactory results. During an attack the hypodermic administration of morphin or codein and atropin gives relief from pain. Sodium bromide and chloral have been recommended in some instances, and olive oil has been found to be a useful remedy. Hot applications to the abdomen and a thorough lavage usually afford great relief from the pain. The drug which is most helpful in the treatment of this condition is atropin prescribed in full doses.

Pneumatosis.

Pneumatosis is characterized by an excessive distention of the stomach with air, the expulsion of which is impossible, causing an unpleasant expansion, with dyspnea. This condition is most frequently induced by a combined cardio- and pylorospasm. As soon as the air escapes, relief is at once brought about. Pneumatosis occurs as a primary neurosis accompanying neurasthenia; it may occur secondary to other affections, as atony, dilatation, and as a result of paralytic ileus. Pneumatosis is observed more frequently in males than females. It appears in an acute type intermittently, causing serious symptoms of dyspnea, collapse, arrhythmia, tachycardia, and cyanosis. The region of the stomach is much distended, the patient being unable to relieve himself by eructating. In the less acute forms the attacks appear either immediately after meals or later, or after exertion. The symptoms are similar to those of the acute forms but far less

alarming. The diagnosis can be readily made from the above noted symptoms.

The *treatment* should be directed toward the nervous system. Change of scene, massage and hydrotherapy are indicated. By means of the introduction of the stomach tube immediate relief can be obtained from the acute symptoms.

Nervous Vomiting.

Vomiting may be due to some fermentation or abnormal condition of the ingested food; to disease of the stomach itself, or to a disturbance of the nervous system. The latter condition is the one with which we are here concerned. There are three forms of nervous vomiting: (1) Nervous vomiting proper, *i.e.*, vomiting due to neurasthenia or hysteria; (2) reflex vomiting; (3) cerebrospinal vomiting due to functional or organic disease of the central nervous system.

The characteristics of nervous vomiting are as follows: The ease of vomiting; its non-dependence upon the quantity and quality of the food ingested, the capriciousness with which very bizarre articles of food are retained to the exclusion of others; the occasional elective vomiting; the ease with which patients bear this condition, even for a long period of time; the very slight degree of inanition produced by habitual vomiting; the extraordinary influence of the slightest external or internal causes that react on the patient's temperament; the occurrence of vomiting, frequently even on a fasting stomach, and the appearance of this condition independently of the meals, the presence of other nervous symptoms associated with the vomiting or alternating with it.

Nervous nausea is closely related to nervous vomiting. It may be purely a functional condition due to neurasthenia or hysteria, or due to affections of other organs. It may be intermittent or continuous, and bear no relation to the ingestion of food. It may persist for days, and is sometimes slight, at other times so intense as to cause vomiting; marked emaciation is not an infrequent result.

Prognosis. The prognosis of nervous vomiting and nausea depends largely upon the causation.

In the cerebrospinal forms it is bad; while in that variety due to neurasthenia, the prognosis under favorable treatment

is good, though occasionally a fatal outcome occurs due to the exhaustion and acidosis produced by the continued nausea and vomiting.

Treatment. Whenever possible the cause must be overcome. In the mild forms, change of scene, avoidance of excitement, and rest, will bring about relief. In severe cases, rest cures under rigid isolation in a hospital or sanatorium should be insisted upon. Liquid diet, given in small quantities, should be at first prescribed. In severe cases, rectal alimentation should be practiced by means of the Murphy drip method. Saline solutions with glucose may be utilized for this purpose. In some cases under our care, duodenal alimentation according to the Einhorn method has been most beneficial. At times solid food is better borne than liquids. Good results are obtained at times from lavage with solutions of nitrate of silver. Drugs have but little influence on this condition.

Eructatio Nervosa (Aërophagia).

Eructatio nervosa is characterized by periodic or paroxysmal attacks of noisy belching. It commonly occurs in neurasthenic and hysterical individuals. The gas which is expelled in this condition is swallowed. Aërophagia occurs as a voluntary act produced to relieve an uncomfortable sensation in the stomach, the air is forced into the esophagus or stomach and by contraction of the esophagus the accumulated air is expelled with a loud noise. The affection is more commonly observed in females than males. It is usually a primary gastric neurosis produced by excitement or worry, yet it may occur as a result of some gastric disorder, as catarrh, gastropptosis, or may be secondary to disease of other organs, as the heart, intestine, or genitourinary organs.

Symptoms. This affection develops suddenly, as a rule, and is accompanied by noisy eructations varying in duration and intensity; the paroxysms lasting from a few hours to days. The attacks disappear suddenly, and cease while the patient is asleep.

Treatment. This condition can usually be controlled by psychotherapy. Special attention must be paid to the patient's nervous system. This can be best accomplished by

means of rest and change of scene. A well regulated rest cure accomplishes much in many instances and relief is sometimes afforded by the use of the bromides.

Rumination or Merycism.

Rumination is characterized by the regurgitation of food into the mouth, which is again masticated and swallowed, or spat out. This condition is not accompanied by nausea but with a rather pleasurable sensation; it is comparable to a similar condition observed in animals. Neurasthenia is an important factor in the production of this disorder. It is frequently due to worry and excitement and often to too hasty eating. It is observed at all ages, and is not uncommonly found in intellectual individuals of middle life, and is at times acquired by imitation. Rumination usually has its origin as a voluntary disorder; the food at first regurgitated producing a pleasurable sensation is again reswallowed and finally the condition is established as an involuntary process. It usually occurs during the early period of digestion, for as soon as the food becomes acid and unpleasant, it is either quickly swallowed or ejected. Merycism occurs alone or may accompany other gastric affections; it is at times associated with atony and dilatation.

The *treatment* is essentially one of autosuppression and the patient can be taught to overcome this disease in many instances.

Regurgitation.

Regurgitation is characterized by the expulsion of small quantities of food from the stomach into the mouth, which are then ejected. The condition occurs in nervous individuals, and is much like rumination except that the food is not again masticated; rumination, however, may develop from long continued regurgitation. The condition is at times voluntary but as the habit becomes fully established it becomes involuntary. Regurgitation may be occasioned by nervous excitement or shock, or it may be secondary to some gastric disturbance, as catarrh, hyperacidity, or dilatation. It is observed frequently at middle life in males and in individuals following intellectual pursuits.

Symptoms. The onset is gradual, manifesting itself by the regurgitation of food soon after meals, and persisting during the entire period of digestion. Nausea is not present; at first the food regurgitated has the same taste as when swallowed, later it becomes acid from the admixture with the gastric juice. The process can be suppressed at times; at times this is impossible.

The *treatment* should be directed to the associated neurasthenia. The patient should be taught voluntary suppression. Psychotherapy has been of great help as an aid in suppressing this condition, in some of our cases.

Gastralgia Nervosa.

By gastralgia is indicated an affection accompanied by periodic or spasmodic pain in the stomach occurring without relation to the ingestion of food and not dependent upon organic disease. Gastralgia must be considered as a neurosis of the vagus and is produced as a result of vagatonia. Einhorn divides gastralgias into five groups. Those of (1) gastric origin; (2) central origin; (3) neurotic origin; (4) of constitutional origin; and (5) reflex origin.

(1) Gastralgias of gastric origin. The gastralgic pains occurring in ulcer and cancer of the stomach are included in this group.

(2) Gastralgias of central origin. In this group are found the pains observed in the gastric crises of locomotor ataxia and in cerebral tumors.

(3) Gastralgias of neurotic origin. This condition is found in hysteria and neurasthenia.

(4) Gastralgia of constitutional origin. This condition is one observed in lead poisoning, anemia, and gout.

(5) Gastralgia of reflex origin. This condition arises as a reflex from the generative, urinary or other organs.

Symptoms. The attacks of pain occur suddenly and are at times preceded by nausea, vomiting and headaches. The pain is of a boring, tearing, cutting or gnawing type and is felt in the epigastrium, radiating at times throughout the abdomen and into the back, with such intensity as to cause exhaustion and symptoms of collapse, producing a weak and thready pulse, cold extremities and perspiration and pallor.

The pains are relieved frequently by pressure and are often accompanied by nausea, vomiting and nervous manifestations, as nervous chills, headaches and globus hystericus.

Treatment. It is important to treat the underlying cause. In the form due to anemia, iron and arsenic should be administered; those due to malaria require quinine. In the reflex forms of gastralgia, the primary affection must be treated. Those forms due to neurasthenia and hysteria should be treated by change of scene, rest and massage. When the patient is much debilitated a systematic rest cure is indicated. For the attacks of pain, hot applications or poultices should be applied to the abdomen and codein or Hoffman's anodyne be prescribed. Belladonna and chloroform water, phenacetin and aspirin have been found useful in some instances. If the pain is intense, hypodermic injections of morphin must be administered.

Hyperesthesia Gastrica.

At times the gastric mucous membrane is unusually sensitive, even to its normal contents; this condition is termed gastric hyperesthesia. There is neither secretory nor motor disturbance at hand and yet the lightest forms of food will cause discomfort in the form of pain, fullness, or sensations of cold or heat. In some cases not only does the food cause discomfort but the normal hydrochloric acid content will produce pain.

Hyperesthesia is observed in neurasthenia and hysteria, and occurs in anemic individuals.

Symptoms. The symptoms produced in this condition are mild discomfort, fullness and burning after meals, which discontinue as soon as the stomach becomes empty. Solid food at times produces less discomfort than liquids. Symptoms of hyperacidity are at times manifested, though the gastric contents may reveal no excess of acid. In such cases the discomfort appears some time after meals, and is relieved by alkalies.

Treatment. It is well in most instances to place a patient affected with this condition in bed, at first on a liquid diet, and best on a systematic rest cure on a gradually increasing diet scale. Cold compresses to the abdomen frequently af-

ford relief. Nitrate of silver, given in solution in doses of from $\frac{1}{8}$ to $\frac{1}{6}$ grain three times a day, or administered by means of the stomach tube, has been of help in some instances. The bromids, valerianates, and sumbul, have been frequently found efficacious.

Bulimia.

Bulimia is characterized by an abnormal increase in the sensation of hunger. This condition has also been termed hyporexia, cynorexia, and lycorexia. According to Cannon, the sensation of hunger is produced by tonic contractions of the empty stomach.

Bulimia may occur as a pure neurosis or it may be secondary to other affections. As a primary neurosis it is observed in neurasthenia and hysteria. It occurs in cerebral tumors, hyperthyroidism, diabetes, syphilis, pulmonary tuberculosis, as well as in ulcer of the stomach. Dock has called attention to the fact that it may be due in some instances to focal infection.

Symptoms. Bulimia occurs usually in attacks appearing at irregular intervals; or it may occur periodically and extend over a long period of time. It manifests itself as a violent sensation of hunger after meals, on account of which the patient is much exhausted, becomes faint, and suffers with vertigo, and cold extremities. As soon as food is taken these sensations disappear. At times but small quantities of food are required to overcome this condition for a shorter and longer period of time; at other times very large quantities of food are needed to relieve it. The inordinate quantity of food is apt to cause other digestive disturbances, such as atony, gastritis, and disturbances of the bowels. The gastric secretion is usually normal in bulimia.

Bulimia must be differentiated from acoria and polyphagia; while there is an abnormal desire for food in bulimia, the desire can be satisfied, while in acoria there is an entire absence of the sensation of satiation. In polyphagia or gluttony, while the appetite continues good, the feeling of satisfaction is delayed so that there is a constant desire for more food. The prognosis of bulimia depends upon the cause. The primary form due to neurasthenia may be of long dura-

tion or may disappear suddenly, while the secondary form depends largely upon the nature of the underlying disease.

Treatment. The treatment must be directed toward the primary disorder. All focal infections should as far as possible be removed. In the primary forms due to neurasthenia, attention should be especially directed to the treatment of the nervous system. In most instances, rest, change of scene, hydrotherapy and psychotherapy, are the important measures for counteracting this affection.

Hyperchlorhydria or Hyperacidity.

Hyperchlorhydria is that condition characterized by an increase in the secretion of the hydrochloric acid produced during the period of digestion. Inasmuch as the excess of acid is simply a symptom, the question arises whether hyperchlorhydria should be considered a distinct disease; yet the symptoms associated with this condition are so distinctive and so often embrace all subjective manifestations, that we are forced to treat this condition as a special clinical entity. While hyperchlorhydria definitely manifests itself in many instances as a secretory neurosis, in a certain proportion of cases it is associated with some definite lesion. The question as to what is meant by an excess of hydrochloric acid has not been fully established, for what might be taken as an excess in one individual may be a normal acidity in another. Although many authors have considered an amount of acid above 0.2 per cent. as representing a hyperacidity, many cases are met with having a greater acidity than this quantity without symptoms of hyperacidity. On the other hand, symptoms of hyperacidity may exist even in cases of hypochlorhydria. Much has been learned in recent years regarding the question of hyperchlorhydria by the studies of Rehfuess and his coworkers, by means of fractional analyses extending throughout the entire period of digestion. It is now known that while hyperacidity may exist, that this may occur at any time during the period of digestion; so that at the end of an hour after a test meal we may find an entirely normal or even a lowered acidity, yet either before or after this period the acidity may be exceedingly high. By means of these examinations we have learned that the very same

amount of acid may indicate a hyperacidity in one individual, and not in another, indicating that individual variations may exist in the normal percentage and that we cannot draw a sharp line between the normal and hyperacid state.

Hyperchlorhydria occurs very frequently. It is most usually observed in young and middle-aged persons, while it is rarer in older individuals. It is slightly more frequent in females than in males. It is more frequently observed among the wealthier classes than among the poor.

The following etiological factors are important:

1. Mental strain, overwork, prolonged worry, are important factors in its production; neurasthenia and hysteria are also important causative factors.

2. Gastrointestinal atony is a marked etiological factor, especially when associated with chronic constipation.

3. Indiscretion in food, such as the use of food of a very indigestible character; the abuse of alcohol and tobacco, are the causes of the largest proportion of cases of hyperchlorhydria.

4. Among the diseases bearing an etiological relationship to this affection are, ulcer of the stomach, chlorosis, cholelithiasis, appendicitis.

Symptoms. The symptoms manifested are, acid eructations, heartburn, pain and burning in the stomach. The acid eructations usually occur at the height of the paroxysms of pain and afford relief from the pain. When the acid secretion is eructated the mucous membrane of the esophagus becomes irritated and heartburn develops. This symptom usually appears after taking acid foods, and is relieved frequently by the ingestion of milk, eggs or meats. The pain may vary from a severe pressure to an acute pain in the stomach, and may extend into the back between the shoulder blades and pass under the sternum to the pharynx (pyrosis hydrochlorhydria). It appears usually two or three hours after meals, depending upon the food taken. In a moderate number of cases the pain appears immediately after food. The symptoms of hyperchlorhydria continue for a variable period of time, disappearing for an hour or more or persisting for many hours. Pain is much more quickly produced by starchy foods than by protein foods, more quickly by light

meals than by heavy meals, and is relieved by the ingestion of food or by neutralizing the acid by means of alkalies.

Usually the pain disappears at night during rest and does not occur again until several hours after breakfast. The severe gastralgic pains are not usually found after every meal, and are somewhat relieved by the acid eructations, and by vomiting of the acid secretion which burns the throat and numbs the teeth as it passes over them. A sensation of burning in the stomach is frequently observed, which is felt in the epigastrium, and may extend to the back. It is relieved by means of food and alkalies. The appetite is good, the thirst increased, and the bowels usually constipated. The examination of the stomach contents after a Rehfuß or ordinary test meal, reveals a normal motility or hypermotility. The gastric juice presents a high degree of acidity; the starch digestion is imperfect, and rather large quantities of amidulin are found; the protein digestion and peptonization is more rapid than under normal conditions, so that none or but few undigested meat fibers are observed in the gastric contents.

Treatment. Diet plays a most important rôle in the treatment of this affection, it being essential that the food should be given in such a form as not to produce any irritation of the mucous membrane of the stomach. As the gastric hyperesthesia is mainly responsible for the hyperacidity, the treatment should be directed to this condition. This would include the removal of all causes of irritation, the prohibition of alcoholic stimulants, all acids, all spices and condiments. All foods to which vinegar or lemon juice have been added should be interdicted; all hard substances, such as nuts, should be avoided. Food should be thoroughly masticated, and should not be taken either too hot or too cold. A liberal mixed diet, consisting of proteids, fats, and carbohydrates, is to be preferred.

In patients consuming but little nourishment, food should be given at frequent intervals; if large meals are consumed, it is advisable to permit only three meals a day, allowing the stomach to rest in the intervals. In severe forms of nervous hyperchlorhydria a purely vegetable, or milk and vegetable, diet have been recommended; the vegetables should be eaten in purée form. In advanced cases with pronounced nervous

manifestations a complete or modified rest cure will accomplish excellent results.

Whenever patients affected with this condition present symptoms of fatigue they should be required to rest, either away at the country, sea shore, or mountains; physical exercise, out-of-door life, and cold sponge baths, are frequently serviceable. Lavage of the stomach is rarely necessary in the mild cases, though it is of great benefit in the severe and obstinate forms.

Alkalies are utilized to neutralize the excess of acid. Of these, sodium bicarbonate, calcined magnesia, magnesium carbonate, and phosphate of soda, are most frequently utilized. The dose of the alkali should be as far as possible proportioned to the heaviness of the meal, as well as the degree of hyperacidity. The alkalies should be administered when the discomfort begins to manifest itself, *i.e.*, about two hours after meals.

Gastrosuccorrhea or Hypersecretion of Gastric Juice.

Gastrosuccorrhea is a condition characterized by a constant excessive flow of gastric juice. The stomach pours out secretion even when free of food, so that large amounts of gastric juice are found in the morning, even before the ingestion of nourishment. This affection is found in three forms: (1) Gastrosuccorrhea continua periodica; (2) gastrosuccorrhea continua chronica, and (3) digestive succorrhea.

Gastrosuccorrhea Continua Periodica. In this condition, in addition to the appearance of acute attacks with a constant secretion of gastric juice, severe gastric pains and vomiting are present. Periodic hypersecretion may occur as a simple gastric neurosis or as a reflex neurosis secondary to disease of the brain and spinal cord, as in progressive paralysis, tabes dorsalis, or myelitis.

The causes are various, among which may be mentioned excessive mental strain, excitement, anger, overindulgence in food and abuse of alcohol and tobacco.

Symptoms. The characteristic signs of this condition are not only the paroxysmal attacks beginning in the midst of good health, but also the special character of the gastric con-

tents and vomitus. The attacks begin early in the morning with lassitude, headache, and loss of appetite, thirst, and pain in the stomach which becomes intense and is accompanied by heartburn and acid belching. The pains are spasmodic and intense, and finally there is vomiting of acid matter containing only food at first, and finally only gastric juice. The attack may thus disappear, or after a short time others may set in extending over a period of a few hours to several days. The quantity of vomitus is usually large in amount, frequently from 200 to 500 cubic centimeters, containing food particles and finally pure gastric juice tinged yellowish or greenish with bile. The vomited matter is very acid and may contain traces of blood. During the attack, in addition to the pain there is loss of appetite, great thirst, and general feebleness; the pulse becomes weak and the patient presents the appearance of suffering; he is pale and debilitated. The urine becomes scanty, of high specific gravity, and the bowels are constipated. The attacks vary both as to intensity and duration. Between the attacks the patient is in good health, usually having but little or no gastric discomfort. The gastric analysis at this time presents usually a hyperacidity. There is a condition known as gastroxynsis which only differs from periodic hypersecretion in that the headaches are more persistent and prominent.

Treatment. The treatment, whenever possible, should be directed to the cause. If due to anxiety or mental strain, these should be overcome by change of scene; physical exercise should be ordered, and the overindulgence in food and drink prohibited.

Relief in some instances has been afforded by means of intragastric electricity. For the attack itself, the treatment advised by Einhorn has been found serviceable; that is, the administration of a moderate dose of bromide immediately at the onset of the attack. As soon as the attack sets in, lavage of the stomach should be practiced with an alkaline solution which should be repeated at varying intervals. For the severe pain, hypodermic injections of morphin must be administered. During the attack, the patient should be allowed but small quantities of fluids, water, milk, and albumin; bits of ice may relieve the throat.

Gastrosuccorrhea Continua Chronica. This condition is known as Reichmann's disease, or chronic hypersecretion. There is present in this affection a chronic continuous secretion of gastric juice, even in the fasting stomach; it may be primary or secondary. It is primary as a gastric neurosis, and secondary when it is due to some other gastric disturbance, as ulcer, dilatation, or atony. Inasmuch as continuous hypersecretion is usually associated with gastric dilatation, and inasmuch as the symptoms of both conditions are very similar, many deny the existence of this condition as a distinct entity and consider it a form of gastrectasia.

There have been cases, however, reported by Reichmann, Riegel and Pickardt, in which this disease existed as a pure neurosis in which careful investigation failed to reveal any organic disease of the stomach.

The causes are much like those of intermittent gastrosuccorrhea, namely, worry and excitement, indiscretions in food and drink. Secondary continuous hypersecretion is frequently the result of pyloric stenosis and ulcer. The primary condition is rare; it is not as frequently observed as the intermittent form.

Symptoms. The most frequent symptoms of chronic hypersecretion are, burning in the stomach, pain, heartburn, acid eructations, nausea, and vomiting of large quantities of gastric juice. The onset is extremely gradual and many patients complain of mild dyspeptic symptoms for months before the true nature of the disease is revealed. At first there is but a slight burning in the epigastrium, and heartburn, which gradually increases; the pain appears several hours after meals, which is relieved by the ingestion of food. This affection is especially observed in attacks at night; after the pain has existed for some time vomiting sets in consisting of large quantities of acid gastric juice. These symptoms are mild in some instances and severe in others; they are apt to appear for a time and disappear to recur again after weeks. In severe forms the symptoms are constant, vomiting occurring five or six times daily, on account of which the patient loses much flesh and strength. The attack can at times be subdued by the ingestion of protein food, such as milk or

eggs. Constipation is usually present and the urine is diminished and of a high specific gravity.

On examination the gastric secretion reveals a marked hyperacidity and there are excessive quantities of gastric juice in the fasting stomach. The protein digestion is good, while the starch digestion is poor. In most instances 100 cubic centimeters, or more, of gastric secretion are found in the fasting stomach.

Treatment. Diet plays a most important rôle in the cure of this affection. The meals should be small but frequent, given at intervals of from three to four hours. The patient should eat slowly and masticate his food thoroughly; all irritating substances, such as pepper, spices, and highly seasoned foods, should be forbidden. The diet should consist largely of proteins, which are best borne, while the carbohydrates must be given in small quantities, in the most easily digestible forms.

Lavage of the stomach is the most efficient means of relieving pain and irritation and should be practiced in the morning before the ingestion of food. Boas advises the simple emptying of the stomach in the fasting state by means of the tube, while Reichmann recommends lavage with nitrate of silver solution, 1 to 2:1000.

Digestive Gastrosuccorrhea, or Alimentary Hypersecretion. This condition is characterized by the secretion of large quantities of a thin watery hyperacid gastric secretion obtained in the extracted test meal. The large amount of contents do not depend upon a delayed motility, but upon an increased gastric secretion. In this condition the increased secretion is dependent upon the act of digestion in contradistinction to continuous hypersecretion in which gastric juice is obtained in the fasting stomach.

Atony of the Stomach.

Atony is characterized by a loss of tone of the muscular walls with a resultant motor insufficiency, in consequence of which the stomach is unable to pass its contents into the intestine at the normal rate. Most writers classify this condition as a neurosis, while by others it is considered a form of gastrectasia.

Atony may be either primary or secondary. Primary atony is observed in nervous individuals who have been the subject of fright, worry, excitement or mental depression. It occurs as a result of the habitual ingestion of indigestible food; the excessive use of fluids is said especially to predispose to this disorder.

It is frequently secondary to disease of the brain and cord, typhoid fever, and tuberculosis. It originates frequently during the period of puberty, on account of the precocious appetite at this period of life leading to the inordinate consumption of indigestible food. Atony appears as frequently in males as in females.

Symptoms. The appetite is usually impaired, the first ingesta causing in many instances a feeling of satiety; occasionally it may be normal. Fullness and pressure is constant after meals. The discomfort may be so intense as to continue with severity for hours after meals, and increase when food is again ingested. The symptoms appear immediately or shortly after meals and usually disappear as the stomach becomes empty. The emptying of the stomach is usually delayed, though this is not always the case; for while peristalsis is usually slow in the beginning of digestion, when it is once begun a full meal may be emptied from the stomach at the normal rate. The full meals distend the stomach and thus cause an increase in tonus and peristalsis becomes active. There is present in addition, headache, pyrosis and eructations, but vomiting is exceedingly rare. Constipation is common, and headaches, vertigo, palpitation and dyspnea are symptoms which are not infrequently noted.

On physical examination the stomach is found usually enlarged, the greater curvature reaching below the umbilicus.

With but small quantities of fluids (250 to 300 cubic centimeters) a splashing sound can easily be produced in the region of the stomach. In atony there is not only an enlargement of the stomach, but its motor function is impaired, the food not being propelled into the intestine at the normal rate; food remains being still present in the stomach for from six to seven hours after meals. On the other hand, if the contents of the stomach be expressed in the morning before the

ingestion of food, the stomach will be found empty of all food remains. This test distinguishes atony from gastrectasia.

The test meal reveals large quantities of solid contents, the chemical examination of which points to a normal acidity in most instances.

Treatment. Inasmuch as atony is frequently produced by injudicious and too rapid eating, individuals with feeble digestive powers should exercise special caution to eat slowly, masticate thoroughly, and avoid indigestible food. Patients affected with atony of the stomach should eat small quantities of food at regular and frequent intervals. The quantity of fluids should not exceed one and one-half liters per day. The diet should be varied according to the nature of the acidity.

The treatment of the chronic constipation associated with this affection should be mainly dietetic, such foods should be given as excite intestinal peristaltic movements.

Massage of the abdomen is to be recommended, to strengthen the abdominal walls, and to increase peristalsis. Duodenal feeding has been of great service in a number of our cases and a well regulated rest cure may become necessary in protracted cases with great loss of flesh. In regard to the medicinal treatment, preparations containing strychnin are indicated.

Anorexia.

Anorexia is a condition in which there is a marked decrease or entire absence of the sensation of hunger combined with an absolute loss of appetite. It may be primary or secondary. As a primary disturbance it is observed in hysteria and neurasthenia. It may be secondary to cancer of the stomach, chronic gastritis, and acute febrile disorders.

Anorexia nervosa usually has its onset after mental excitement and anxiety.

Symptoms. After great mental strain, loss of appetite manifests itself, which may become so marked that a repugnance for food is produced and in consequence of which the patient loses weight and strength, and becomes pale and anemic. In addition, nervous symptoms present themselves in the form of excitability, restlessness, and insomnia. When

the disease is most marked the patient presents the appearance of tuberculosis, and death may ensue due to exhaustion or some secondary infection.

Treatment. In mild cases one should insist that the patient take sufficient nourishment; for this reason the patient's taste should be consulted and the food varied as much as possible. By means of psychotherapy much can be accomplished in this direction. The bitter tonics are sometimes of great help. Of these, gentian, quinin and strychnin are frequently beneficial. Lavage with a bitter infusion or with a normal salt solution has been recommended. The nervous system should be treated by change of scene, rest, massage, and hydrotherapy. In all serious cases the patient should be isolated in a hospital or sanitarium and given a rigid rest cure. This method of treatment together with feeding by means of the Einhorn duodenal tube, the writers feel confident, has saved the lives of a certain number of their patients affected with this condition.

Achylia Gastrica or Anacidity.

Einhorn introduced the term achylia gastrica to denote that affection in which there is an absence of gastric secretion. This term, however, simply designates a symptom, the underlying cause being a severe form of chronic gastritis, or gastric atrophy, or a purely neurotic condition. Cases accompanied by a complete atrophy of the gastric mucous membrane, such as were first described by Fenwick and as are observed in pernicious anemia, have been described elsewhere. The term achylia gastrica is best restricted to those forms to which Einhorn first applied it. In these there is an absence of gastric secretion which persists for years without ending fatally, and at the same time the general health of the patient remains normal; there are frequently no subjective symptoms whatever, and a varied diet may frequently be taken without producing discomfort, the small intestine vicariously assuming the function of the stomach. In one of our cases the affection persisted for twelve years, with gain in weight and with but few attacks of intestinal indigestion.

Etiology. In order to determine the presence of achylia gastrica, a fractional analysis of the gastric contents accord-

ing to the Rehfuß method is extremely important in all cases, as by means of this method we are enabled to differentiate the true from the spurious forms. This differentiation is important, inasmuch as many of the false achylia present a high hydrochloric acid index, sometimes marked hyperacidity, and are in fact really cases of delayed hyperacidity. In the true achylia free HCl is absent in every specimen and the total acidity is low.

Achylia gastrica is observed in neurasthenic patients. It may remain latent without making serious inroads into the general health, especially in those patients in whom the motility of the stomach remains normal, and the intestinal functions are undisturbed.

From the observation of certain patients for at least fifteen years, Stockton believes that, in the absence of or with a low standard of gastric secretion, individuals are always found to have impaired health even with relatively good intestinal digestion.

Achylia gastrica is usually observed after the thirteenth year of life and increases in frequency in middle life. It occurs with equal frequency in males and females.

Symptoms. Einhorn divides achylia gastrica into three clinical groups:

(1) Individuals presenting no gastrointestinal symptoms whatever and who are in good general health.

(2) Patients presenting more or less gastric discomfort.

(3) Patients having apparently no gastric symptoms but who present marked intestinal disturbances.

In the first group are found the smallest proportion of cases. The individual presents no loss of flesh, subjective symptoms are absent, and the diseased condition is usually noted by accident. The largest proportion of cases are observed in the second group, in which the symptoms are mainly gastric. These consist of loss of appetite, discomfort and pressure in the region of the stomach, and occasionally merely burning with pressure after meals and persisting for some time. In some instances there is no pain whatever, while in others it occurs with great severity. Nausea and vomiting are rare. The vomited matter usually contains undigested food remains. Eructations and pyrosis are occa-

sionally observed, and at times symptoms are present which are not unlike those observed in hyperchlorhydria—that is, pain appearing two hours after meals, relieved by the ingestion of food; nervous symptoms are frequently noted. The third group contains those patients having apparently no gastric disturbances, but presenting intestinal symptoms. The most frequent symptom is diarrhea, which is at times associated with gurgling in the bowels, and intestinal colic. Not infrequently constipation alternates with diarrhea.

The gastric content obtained after a test meal is moderate in quantity, with a small amount of fluid with bits of undigested bread. The contents are neutral or slightly acid, the total acidity varying between 2 and 10; hydrochloric acid is not present, and pepsin and rennin are entirely absent, although the rennet zymogen may still be present; the test for propeptones and peptones is negative, and there is an absence of mucus. Fragments of mucous membrane often appear in the contents, indicating the great vulnerability of the mucous membrane. The motor function of the stomach is usually increased.

Treatment. This is mainly dietetic and although it is necessary to restrict the diet materially, it is important to insist on the ingestion of sufficient nourishment, as many of these patients are weak and have lost flesh. An attempt should be made to increase the general nutrition of the patient. For this reason the motor function of the stomach should as far as possible be maintained in its normal state, and any disturbance of the intestinal canal should be guarded against. It is important to arrange the diet, so that it can be acted on easily by the intestinal juices. The food must be broken up into as fine particles as possible and should to a large extent be given in liquid and semisolid form.

Lavage is to be recommended in those instances in which the gastric motility is somewhat impaired. Drugs are not required; in some cases dilute hydrochloric acid may be administered, well diluted, in 15-drop doses three or four times at intervals of fifteen minutes, after meals, with benefit. For anorexia, strychnin combined with bitter tonics is recommended.

Hypochlorhydria or Subacidity.

By subacidity or hypochlorhydria is meant that form of neurosis in which the acidity, as well as the other constituents of the gastric secretion, are lessened. One can only make a positive diagnosis of this affection by utilizing the Rehfuß fractional method of analysis. Hypochlorhydria is commonly observed in certain organic diseases of the stomach, as in chronic gastritis and cancer. In the nervous forms, however, there is no evidence whatever of organic disease. This affection is frequently found in neurasthenia or hysteria.

Many cases are observed which present no symptoms for a long period of time; this is especially true when the motor function of the stomach remains normal, but as soon as this function is impaired, fermentation sets up in the intestines and distention takes place.

The *symptoms* of this affection are not positive and the diagnosis can only be arrived at by an examination of the gastric contents. A symptom which may lead one to suspect the presence of this affection is a persistent diarrhea, which is due to a disordered intestinal function following the hypochlorhydria, in consequence of which the patient becomes emaciated and weakened.

The *diagnosis* is arrived at by an examination of the gastric contents by means of the Rehfuß method of fractional analysis, when a constant diminution of hydrochloric acid is observed in every specimen of gastric juice obtained; at the same time neurasthenic and hysterical symptoms must be present.

The *treatment* is largely dietetic; the food should consist mainly of carbohydrates. Meat must be given in the most digestible forms and finely divided. Attention should be given to the general health and nervous system of the patient; hydrochloric acid should be administered in from 10- to 20-drop doses after meals, and lavage should be practiced provided the motor function of the stomach is disturbed.

Nervous Dyspepsia or Neurasthenia Gastrica.

In nervous dyspepsia a combination of gastric neuroses occurs, which is characterized by the presence of a multi-

plicity of symptoms and yet no organic changes are observed. In this affection all the functions of the stomach—motor, sensory and secretory—may be disturbed at the same time.

As causative factors in the production of nervous dyspepsia are, worry, anxiety, overwork, sexual and alcoholic excesses, and the abuse of coffee, tea, and tobacco.

Nervous dyspepsia is characterized by a multiplicity of *symptoms* varying in their mode of onset and intensity. Gastric discomfort is usually present after meals, though this condition is in no way dependent upon the quality and quantity of food ingested but rather upon mental strain and excitement. At times the most digestible food causes discomfort while indigestible food produces none. The gastric distress is in the nature of eructations, pressure, fullness, distention, nausea, and heartburn. Other manifestations of neurasthenia develop, as headache, vertigo, depression, and insomnia. The appetite is capricious—often good, followed by severe anorexia.

The patient's general health is not usually impaired, though at times the emaciation may be so extreme as to suggest some serious organic affection. Alternation of periods of well being with those of discomfort, as well as the variations in intensity of the symptoms at short intervals, are not uncommon in this disorder.

The gastric secretion ordinarily presents a normal acidity, although at times hyperacidity or hypoacidity may occur.

The *diagnosis* is arrived at by the absence of any indication of organic disorder together with the associated neurasthenic symptoms and is more fully confirmed by the finding of normal motor and secretory functions of the stomach.

Treatment. The treatment must be so constituted as to aid in the general building up of the nervous system of the patient; drugs are rarely indicated, and recovery can only be brought about by following a proper mode of living and hygienic laws.

If possible, it is important in all instances to determine the cause, which must be relieved; *i.e.*, excitement and worry must be overcome and physical causes corrected.

The diet is of great importance; this should not be too restricted but should be strengthening and given in liberal

quantities. The patient's appetite should be humored, especially if the food desired is nourishing.

The most beneficial results are obtained from rest cures, forced feedings, and duodenal alimentation.

VISCERAL ARTERIOSCLEROSIS.

Visceral arteriosclerosis occurring during middle life, as associated with the digestive tract and especially the stomach, has hitherto not been accorded sufficient attention, according to our experience, this condition occurring much more frequently than is usually acknowledged.

Of our five hundred cases of gastric disorders of middle life, arteriosclerosis appeared in thirty-three instances (6.2 per cent.), almost twice as frequently in males as in females. The incidence according to age is as follows:

Ages in years	Male	Female
40 to 45	5	2
45 " 50	9	4
50 " 55	7	6
Total	21	12

As individuals advance in years and arteriosclerotic changes slowly make their appearance, disorders of digestion become more common and indigestion can then only be avoided by care in diet. Samuel Fenwick has noted that twenty-one per cent. of all elderly individuals suffer more or less from chronic indigestion. On the other hand, W. Saltau Fenwick notes that of every hundred cases of chronic indigestion in elderly individuals, sixty-six are secondary to organic disease of some important organ of the body, while the remaining thirty-four owe their symptoms to a progressive degeneration of the secretory structures of the stomach and intestines.

As has been previously noted, arteriosclerosis leading to gastric disturbances may be observed in one of two distinct types:

1. Those instances in which the arteriosclerotic changes are primarily in the stomach itself.
2. Those in which the manifestations are secondary to a general arteriosclerosis.

An etiological factor concerned in the production of this condition is the natural wear and tear of life, as manifested in the changes in the blood-vessels with advancing years. In many instances these changes may not be noted until the onset of old age; while in others they appear early, already being fully developed in middle life. There can be but little question that the early onset of this condition is frequently due to such factors as overwork, mental overstrain, over-indulgence in food and drink, syphilis, other infectious diseases, and toxic factors such as gout, lead poisoning, alcohol and intestinal toxemias. Heredity often plays an important rôle, as one frequently observes early arteriosclerosis in members of the same family.

Pathology. The pathological change is degenerative in character, affecting both the arteries and also the walls of the stomach. The arteries may be partly or almost wholly occluded, due to the increase in connective tissue in the intermediate layer, as well as to the proliferation of the endothelium. The new connective tissue formation may occur diffusely or in circumscribed areas in the larger vessels, the endothelium often proliferating or undergoing fatty degeneration. Cystic degeneration often takes place in the newly developed connective tissue, producing the well known "atheromatous cysts"; these, extending into the vessel's lumen, may produce emboli, or ulcerations with thrombotic formation. Calcification may take place in the newly formed fibrous tissues of the intima, and atrophy and calcification in the muscularis and adventitia.

Symptoms. The main clinical gastric manifestations recognized in middle life as the result of general arteriosclerosis and of arteriosclerosis of the abdominal arteries may be divided into three groups:

1. The dyspepsia due to general arteriosclerosis.
2. Abdominal angina.
3. Gastric ulcer, with or without hemorrhage.

The Dyspepsia Due to General Arteriosclerosis. These symptoms usually begin insidiously and are principally manifested in the form of flatulency, fullness, distention, nausea, eructations, dizziness, palpitation, and shortness of breath.

At first but a few of these symptoms are noted, and then only on awakening in the morning, and are often relieved by eructations of gas. The appetite for breakfast gradually diminishes and the patient finally is unable to eat until the noon meal. While the noon meal may be taken with relish, the symptoms above noted are apt to return in the afternoon and epigastric distress is not uncommon. As time goes on, the general abdominal distention, distress, and eructations, are constantly at hand. Nausea and retching after meals are not infrequent, but vomiting is rarely noted. Tachycardia, dyspnea, tightness of the chest, are not uncommon, adding further to the distress of the patients. The flatulency at times increases in severity, especially at night, and the patient is forced to sit up in bed in great discomfort, making efforts to eructate and often suffering with marked dyspnea.

The night attacks are frequently increased by the evening meal, and on this account the patient frequently places himself upon a liquid or semisolid diet.

The symptoms just noted may exist with varying degrees of intensity for years and may even disappear for a short period of time, often to return with great severity. At this period, however, the dyspnea, flatulency, and epigastric distress appear, on slight exertion, even without the influence of food. Intestinal flatulency and distress now manifest themselves and the patient loses weight and strength, the symptoms progress, and the patient may die either from an intercurrent cerebral, cardiac, or renal complication, or from exhaustion.

Abdominal Angina. Abdominal angina occurs frequently as the result of an abdominal endarteritis. These changes of an inflammatory and degenerative character set in slowly in the abdominal aorta and its branches, are progressive and are also the cause of ill defined though often severe abdominal pain. This pain is usually of a paroxysmal character, is often increased on exercise, is relieved by rest and is associated with tenderness on pressure along the aortic plexus and with lancinating pains extending along the course of the iliac and femoral vessels.

Harlow Brooks has called attention to the fact that the disturbed visceral function often associated with pain and

elevation of blood-pressure, which cannot otherwise be accounted for, is frequently the cause of some localized area of abdominal arterial disease.

The pain caused by arteriosclerotic changes in the abdominal aorta may be observed in the epigastrium, thorax, or lower abdomen. Like angina pectoris, it is ordinarily increased on exertion or excitement and is accompanied with tachycardia and hypertension. The pain is often transmitted into the dorsal and lumbar regions of the spine, and disappears under the influence of rest and the administration of the nitrites. According to Allen Jones, "it may be termed abdominal claudication and is accompanied by a consciousness of heavy, hammering, intra-abdominal pulsation, which rivets the patient's attention, is somewhat alarming, and prompts him to seek immediate physical and mental relaxation."

When the gastric branch is involved in this condition, epigastric pain, often of a severe type, is induced by a full meal, which is not entirely relieved until the stomach has entirely emptied itself; light meals producing but moderate discomfort.

Gastric Ulcer, With or Without Hemorrhage. The character of the formation of these ulcerations has already been described. They are definitely due to degenerative changes as a result of marked ischemia of certain parts of the gastric wall, caused by an arteriosclerosis (often a thrombo-angitis) of a branch of the gastric artery. A frequent cause of the hemorrhage is found in the rupture of the miliary aneurisms in the small gastric arterioles.

The diagnosis of ulcers of this form is not always easily accomplished, for they may be mistaken for simple ulceration inasmuch as the symptoms occasioned are not unlike those observed in that disorder.

When in individuals at middle age, with evident manifestations of arteriosclerosis, the usual signs of ulcerations occur, one should always suspect the presence of this affection. On the other hand, inasmuch as carcinoma may have its onset in a similar manner, the diagnosis may become even more complicated.

When hemorrhage occurs with this form of ulceration the diagnosis becomes much less difficult, though, as has already

been noted, hemorrhages do occur, even of a massive type, as a result of the rupture of the arteriosclerotic vessels in the stomach. Cases of this character have been reported by Simon and a number have been under our observation. The following case illustrates this condition: A male patient of sixty years of age, affected with general arteriosclerosis but without any gastrointestinal symptoms whatever, was awakened one night with a sudden massive hemorrhage, from which he died within a few hours. At the autopsy a rupture of a small artery in the stomach, which had undergone marked sclerotic changes, was noted.

Diagnosis. In order to arrive at a correct diagnosis, a thorough general examination of the patient should be made and not too much reliance should be placed upon the mere symptoms of indigestion.

In a patient during middle life complaining of flatulency, distention, and with epigastric pain and dyspnea which are relieved by eructations, especially when these symptoms are aggravated at night, a careful examination into the cardiovascular system should be made. Not infrequently there will be revealed a marked hypertension, with an enlarged heart, with an accentuated second aortic sound or a murmur over the aorta, pulsation in the episternal notch, discomfort on pressure along the abdominal aorta, together with an increase in the urine, which is of a low specific gravity and contains albumin and casts. These findings point directly to the arteriosclerotic changes as causative factors in the production of the gastric affection.

Treatment. In the treatment of visceral arteriosclerosis special attention should be directed toward the general health of the patient. All foci of infection should as far as possible be removed, and improvement in the patient's general health brought about by means of hygienic and dietetic, as well as medicinal measures.

Among the hygienic measures to be recommended in the treatment of these patients are, moderate exercise, warm baths, and fresh air. Excitement should as far as possible be avoided, and sufficient mental and physical rest should be insisted upon.

The dietetic treatment is of primary importance. While the food should be nutritious, it must be easily digestible, and above all the evening meal should be limited in quantity and so constituted as to avoid as far as possible the formation of gas. In general, a lacto-vegetable diet is to be recommended.

Protein food, especially of the animal variety, should be greatly restricted; and tea, coffee, alcohol and tobacco be allowed only in limited amounts. The white meats and fish are allowable in minimal quantities, and in some instances it may become necessary to mash and strain the vegetables. Cereals and well toasted bread are to be recommended in liberal quantities. It is important under all conditions to restrict the use of salt, and in aggravated instances the food must be cooked free of salt.

The remedies to be utilized in the treatment of this affection are much like those ordinarily administered in general arteriosclerosis.

Of the drugs to be recommended are the nitrites, either in the form of nitro-glycerin or sodium nitrite, sodiosalicylate of theobromine, potassium iodide, sajodin and benzylbenzoate. Thyroid extract has been utilized with great benefit in many of these patients affected with an associated obesity.

Diseases of the Intestines and the Cirrhoses of the Liver

BY

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Diseases of the Intestines and the Cirrhoses of the Liver.

CONSTIPATION.

FOREWORD.

CONSTIPATION is merely a symptom and occurs in many disorders and diseases. As a symptom this is the commonest of disorders of the human being and much has been written on it even in ancient times. Various opinions as to its importance are held by different observers, some believing that it is a common cause of serious conditions that may arise in the body and others that its importance has been overestimated.

Keeping in mind the irregularity of bowel movements it is not easy to be dogmatic as to what these should be, in intervals of time, to be considered normal. It must be manifest, with the presence of stasis in the ileum or whatever cause may bring about a delay, when the débris from a meal taken as previously as forty-eight or more hours occurs in a movement; these taking place daily and apparently no constipation existing. Taking examinations of numerous normal people as a standard, it may be said that an individual is constipated in whom the débris from a meal eaten thirty-six hours previously is not present in the rectum ready to be evacuated or the evacuation having already occurred. Of course it is manifest that when the bowels do not move for a number of days, then definitely the thirty-six hour time has elapsed and that individual is constipated. It may further be standardized that if a person has regular movements of the bowels at the same time each day the latter part of the stool being mushy or semi-solid, that this individual is not constipated. This also holds true in those who have more than one stool a day. Another important point is that where no constipation exists there is a feeling of complete satisfaction and emptying of the rectum after each evacuation.

ETIOLOGY.

The causes of chronic constipation are numerous and in each instance all possible factors should be investigated and if possible corrected. Among these in their head lines are the following:

Habits. There is no doubt about it that ignorance, laziness and false modesty are largely responsible for constipation. By ignorance I mean that state of mind found most often in women, particularly in the younger ones, in whom the necessity or importance of regular movements of the bowels has never been inculcated—and if so, was not believed. It is a well-known fact, in rectal work as well as in vaginal examinations, that the average woman has feces collected in the rectum, which is not commonly the case in a man. Men are more particular about having efficient movements of the bowels, and are observant in this connection, whereas women have a fashion of not talking about their movements in these terms and are not really very observant as to whether the stool passed seems to be a complete evacuation, or whether a sense of being empty after the stool takes place.

By laziness is meant a carelessness in responding to the call of nature and holding back, waiting for a more favorable time and place, which practice if continued long enough will eventually increase the constipation. There usually is a complete lack in these individuals of any effort to maintain a regularity of movement of the bowels, and commonly the slightest reason is taken advantage of for deferring this act. Among the worst offenders in this connection are the people of the wealthy class rather than the working people, and these individuals are those in whom the largest percentage of sedentary life exists. In this same connection may be mentioned false modesty, although it has been my observation of late years that women and men are getting away from this, usually having the faculty of departing from the company of others under some subterfuge long enough to retire to the toilet.

The study of people also suggests that those who live in cities are not more constipated than those in the country

districts. While I have no statistics of positive data, it is my impression that the people of country districts are even more constipated than those in the cities.

Diet. There is no doubt that faulty diet is largely responsible for habitual constipation. The factors which have to do in bringing this about are many. Some people do not eat enough for bulk in the intestines to stimulate sufficient peristalsis for evacuation. Others eat too much of the kind of food in which the native proteins predominate, and a large protein content in the intestinal canal means a low stimulating power on the peristalsis. There is no doubt about it, that bulk of food is necessary for what may be termed regular daily movements. The constantly growing habit of partaking of larger and larger amounts of cane sugar is a constipating factor. The same may be said of starches and flours, particularly those which have been prepared. The modern breakfast foods, of the instant and ten-minute varieties, have a low stimulating power on peristalsis. In the polishing and preparation of most of them the hull and chaff have been taken away, and while they have been rendered more palatable to the taste the stimulating elements in them have been removed. The demineralization of other foods is also a factor, as is excessive intake of vegetables high in cellulose and fruits high in the lower grades of sugars. Very often individuals are met with who do not take sufficient fruit in the course of a day. Water is one of the best intestinal stimulants we have, and while excessive drinking is wrong, too little drinking is also wrong, because then the emunctories of the body have difficulty in carrying on their normal functions. Another factor of importance is eating at irregular times. If one keeps in mind the mass pendulent movements of the colon stimulated by the taking of food, the importance of stated hours for the taking of meals is readily seen.

Defecation Position. With the advent of the house as a human abode it is surprising that the builders of early out-houses did not recognize the fact that before they had houses the normal position of defecation was much lower than that possible to be brought about by the high shelf used to sit upon. In modern buildings the height of the average toilet

seat is 18 inches, and the only position possible for the lower extremities, with the feet resting on the floor, is approximately that in the average chair. The proximity of the thighs to the abdomen reinforces the abdominal muscles and causes a distinct relaxation of the lower pelvic outlets. With the average toilet seat, correct position can be brought about in one of two ways, either by leaning the body forward so that the abdomen presses upon the thighs, or with the body in the normal upright position and the feet raised by a stool or some such arrangement, so that the same effect is brought about. The former is distinctly more preferable, since no added means is necessary.

Functional Disturbances of Intestines. Among the more common causes of constipation the following are presented: Atony of the colon; dry colitis; deficient function. In these conditions constipation is usually present. There are often prolapsed organs with more or less atony of the right colon or deficiency of the haustral contractions in the left. To diagnose these, x-ray examinations of the colon must be made, as well as proctoscopic examinations of the mucous membrane of the rectum and rectal dome. These conditions are usually found in the indolic and mixed types of chronic excessive intestinal toxemia, and the constipation is therefore symptomatic. It is probable that the constipation is responsible for the drying of the mucous membrane, because I have observed that when it is possible to bring about normal movements of the bowels the mucous membrane takes on a much more healthy appearance—this usually requiring three or four months of time.

Spastic Constipation. Hyperfunction. There are many cases of constipation due to irregular spasm found in the left half of the colon, and I have not infrequently seen the left colon, from the sigmoid to the mid-transverse, contracted down so that the barium shadow represented but a thin line. An x-ray examination is necessary to diagnose this. It is believed that this type of constipation is bound up in some endocrine disorder and largely in the condition that is called vagotonia. While this may be so, because these factors do exist in a number of such patients at the same time, it is my belief that the spasm is due to the presence of irritative

contents in the intestine which affects the musculature in spastic ways; and the commonest cause of this state is a saccharobutyric intestinal toxemia, in which the anaërobes are the prominent factor, the stool being highly acidulous in reaction. That this must be true is proven by the fact that when the biology and chemistry can be changed to approximately normal the spasm area no longer exists.

Flexure Defects. Malposition. Not uncommonly one sees marked constipation in cases which have a definite falling forward of the hepatic flexure, sometimes the flexure being so low that it almost occupies the ileocecal region, the ascending colon doubling up on itself. There are many instances of incomplete rotation of the colon in which all of the abdominal viscera are in normal position excepting the hepatic flexure. The hepatic flexure anatomically should be at a fixed point in the posterior wall of the abdominal cavity.

Senile Constipation. Exhaustive Function. In advanced years constipation is a common condition. Such individuals are usually no longer robust, but deficient in vitality, living sedentary lives, and have not only deficiency in the motor power of the hollow viscera of the abdomen but in the secretions of the gastrointestinal canal as well.

Strictures. Strictures, both benign and malignant, providing there is no ulceration, are common causes of chronic constipation. Such strictures usually bind down the structures of the gut wall, perhaps bridging across and usually occluding its lumen.

In rare instances *tumors* within, but most times without, the gut wall press upon its lumen and in that way obstruct the transit through.

Stomach Conditions. In diseases and conditions of the stomach, such as hypochlorhydria, ulcer, cancer, dilatation, and achylia gastrica, constipation may be present. The same is true in an obstruction to the entrance of bile into the intestine or deficiency of bile. Diseases of the heart, lungs, liver and kidneys bring on an intestinal hyperemia and congestion of the portal system which may retard the peristalsis. In quite a few chronic diseases of the pancreas, constipation is met with, the same being true in diabetes, anemia, and

arteriosclerosis, and many diseases of the brain, spinal cord, and nervous system. Acute febrile conditions are usually accompanied by constipation due to deficiency in the secretions.

Rectal Conditions. Constipation may be caused by hypertrophied O'Beirne's sphincter, in which the feces collect in the sigmoid flexure and are therefore prevented from reaching the rectum, owing to the frequent and persistent contraction of the sphincter as soon as the stimulus reaches it.

Hypertrophy of the rectal (Houston's) valves, generally a result of chronic colitis, ulceration, and other affections of the lower bowel, may cause constipation. Occasionally one meets with constipation due to hypertrophy of the levatores ani muscles. When present they can usually be felt as thick, rigid bands at the sides of the rectum, about two inches above the anus. Hypertrophy and spasm of the anal sphincter are not unfrequent causes of obstinate constipation. In rare instances coccygeal deviation and perhaps foreign bodies may cause constipation.

A common type of constipation is that due to atony of the rectum in which the viscus acquires a voluminous shape, the caliber sometimes being as wide as four or five inches. Lastly constipation may be present in anal fissures and hemorrhoids, particularly of the internal variety.

DIAGNOSIS OF CONSTIPATION.

In the presence of a history of chronic constipation a search for a cause should be engaged in. This may be found in the life custom of the individual, his habits or his diet. X-ray examination of the colon should always be made as part of the routine. Following this a proctoscopic examination is called for. When careful diagnostic work is done to ascertain the cause of constipation, the relief of this symptom without medicinal means is usually brought about.

TREATMENT.

As has already been stated, constipation is a symptom and thus the cause of the constipation should be searched for and treated. With people who are habitually constipated,

with a movement every second or third day, and in good state of general health, it might be wiser not to engage in any method of treatment. But while the subject of chronic constipation has been largely overdone in its significance in medicine, it yet has an important bearing in the accomplishment of results possible by treatment, results which are favorable to the individual's health and sometimes most beneficial. Ignorance and false modesty, as well as slow response to the rectal reflex for evacuation, often call for stern advice. The hygienic method of living, proper out-of-door life and exercise, and the diminution of strain and worry, are often called for, and as few purgatives as possible should be employed. Regularity should be taught, which means that a patient should repair to a toilet at a regular time each day, preferably before breakfast, and should remain sitting on the toilet for five or ten minutes, even if there is no desire for the bowels to move. If then nothing is accomplished a glycerin suppository or small enema of cold water may be used. By persisting in this, regularity may in some instances be brought about.

Diet. Water should be taken in considerable quantity before breakfast, and after meals through the day, and several times between meals. Foods to avoid are, too much protein food, too much cane sugar and a diet too rich in carbohydrates or fats. Milk, red wine, tea, chocolate, and cocoa, are constipating with some people. The diet should be largely vegetables and fruits, with, perhaps, the liberal use of olive oil. Apples in the evening before retiring are sometimes beneficial.

The plan of the diet is to eat three meals a day with nothing between times. The food should be of the normal kinds and simply cooked.

Drink at least five glasses of water a day, preferably before meals and between them, not during the meal. Any of the customary foods can be eaten, but do not take more than two eggs in a day, and take meat, fish and fowl but once a day, and this once in very small quantity.

Milk, tea, or sour wines, are forbidden, and no foods containing pits or seeds are allowed. Fruits, raw or cooked, should be eaten morning and evening, the liberal use of

honey and the use of milk sugar instead of cane sugar on foods is advisable.

At breakfast each morning instead of a cereal, or with oatmeal, eat a handful of finely cut agar-agar with fresh cream. Agar-agar may be purchased from the local druggist. During the course of the day eat one to three of the following gems, which should be baked twice a week:

Bran Gems. Two cups of bran, 1 cup of flour, 1 cup of milk, $\frac{3}{4}$ cup of molasses, $\frac{1}{2}$ teaspoonful of baking soda (dissolved in hot water), $\frac{1}{2}$ teaspoonful of butter, $\frac{1}{2}$ teaspoonful of lard, salt to taste. Bake in a slow oven 45 minutes.

If it is not possible to take the bran gems, take one or two tablespoonfuls of wheat bran cooked in milk with cream and sugar.

At dinner or before retiring, take a dish of stewed prunes cooked in milk sugar or honey. It may be found that apple sauce sweetened with milk sugar will work as well as the prunes. If so, alternate this with the prunes, eating one on one day and the other the next.

At certain times each morning and evening make an effort to stool. This should be persisted in even if no success is obtained in the beginning. Its object is to establish a regularity in time. However, at any other time when the desire for stool comes on respond to it at the earliest possible moment.

Very often one has to write an individual diet to fit the individual condition of a person who is constipated. In this instance any of the above anti-constipation additions may be added to the diet, although the following serves admirably as an additional diet—that is, anti-constipation additions which may be added to any diet:

Measures to encourage the bowels to move in a normal way are the following: Begin by taking three of the following bran gems during the course of the day, and if you cannot get them, take in place of them a good-sized dish of pettjohn bran, or from 1 to 2 tablespoonfuls of wheat bran mixed with oatmeal or shredded wheat biscuit for breakfast.

Bran Gems: One-half teaspoonful of soda, saleratus, dissolved in $\frac{1}{2}$ cup of hot water. Add, when dissolved, $\frac{3}{4}$ cup of molasses, then a tablespoonful of butter, salt to taste, 2 cups of wheat bran, 1 cup of bran meal, 1 cup of milk. Mix all the ingredients together, put in muffin pans and bake 45 minutes in a slow oven.

If the above does not move the bowels, retain the bran method which you are employing, and as an additional method take a dish of stewed prunes cooked with milk sugar or honey, or molasses, at the evening meal or before retiring.

If the foregoing two methods are not sufficient, take the prunes at the evening meal and a tablespoonful of petroleum jelly or vaseline, before retiring. With the institution of this take from 3 to 6 glasses of water during the course of the day, in the intervals between the meals and on arising and before retiring.

If then the bowels are not moving, add a few senna leaves to the prunes which are being taken, these being put in at the time of stewing.

If still the bowels do not move, drop the use of the bran, both in the biscuits and at breakfast, and substitute a handful or $\frac{1}{2}$ ounce of finely cut agar-agar, eaten with cream and sugar at breakfast. This may be mixed with a cereal but not cooked with it.

The foregoing methods should be followed, beginning with the first and adding one thing after the other until the desired result is accomplished. Do not become alarmed if the bowels do not move in the beginning, or if a day goes by during the time of the above additions.

The use of *agar-agar* has been resorted to by some practitioners for a considerable number of years and there is no question that it has distinct benefit. In my experience, however, it cannot be depended upon alone and I rarely use it alone excepting in the diarrhea cases where constipation also exists. By that I mean where a number of movements of the bowels have taken place in the course of the day and there still remains back in the colon considerable dry feces. For the reason that agar-agar is not efficient it has been mixed with various drugs. A proprietary combination going under the name of Regulin, a combination of agar-agar and cascara, is an efficient preparation. The same is true of agar mixed with phenolphthalein.

Bran, which takes up water, is indigestible and therefore it increases the roughage in the intestinal content and contains some intestinal stimulant and often serves to good purpose. It may be mixed with various foods, such as shredded wheat biscuit or cooked in various forms of bread and cake.

Baker's yeast, of which I have used considerable, serves to good purpose for chronic constipation with some individuals. While we do not know why, it does occasionally serve to regulate the bowels.

For a long time various preparations of *mineral oil* have been used for the alleviation of constipation, and while in some instances it does excellently, in the majority it is not to be recommended. Ofttimes the oil comes away without carrying any stool and we are told in this instance we are giving the oil in too large a quantity. While this may be true, nevertheless the giving of smaller quantities has often been disappointing to me. I believe that a better preparation than the fluid forms of oil is the soft form of paraffin, which is best employed in the form of petroleum jelly (vaselin), which is readily taken in the same way as mineral oil. It may be warmed so that it can be drunk.

Lastly it should be mentioned that prunes cooked with any of the "dog sugars" are quite stimulating to peristalsis. For this purpose milk sugar, glucose, honey or molasses answers well. Sometimes the cooking of a few senna leaves with the prunes is all that is necessary for just one addition to any diet to overcome a moderate degree of constipation.

Massage. Various forms of massage have been engaged in to overcome constipation. My experience has been that while they are helpful, they are rarely ever in themselves sufficient to overcome the condition. For a long time, the use of a three- or five-pound cannon ball rolled well over the abdomen and the coils of the colon and small intestine in a spiral manner, the patient in a dorsal position, was recommended. This procedure I object to, as well as I object to all forms of mechanical massage which the individual uses himself. It is very liable to make him too introspective and self-centered upon the condition.

Electricity. Of considerable value is the use of the sinusoidal current with a large electrode fore and aft on the abdomen. Various other types of current have been employed, sometimes with benefit but most often not so.

Exercise. In my opinion one of the most valuable methods of overcoming chronic constipation is the use of regular exercises. Of these there are none better than the United States army setting-up exercises, engaged in for ten or fifteen minutes each morning. Not a few of my patients have accomplished regular movements of the bowels by drinking

one or two glasses of cold water on arising and then engaging in the setting-up exercises.

Dilatation. Hirschmann believes that the direct stimulation of the atonic rectum and sigmoid by means of mechanical dilatation has, up to the present time, given the best results in cases of chronic constipation. For this purpose he used a rubber bag with a stem, which is slipped over the distal end of a Wales bougie, 3-5, this bougie being canaled. Compressed air at a low pressure is allowed to enter the bag slowly and distention to any desired extent is produced. I have employed this method and I do not see any benefits from it.

Enemata. Enemata with hot saline solution, given at the temperature of 110° to 120° F. for fifteen minutes three times a week alone, or combined with electricity or with the alternating cold douche, about 60° F., may prove of service in very obstinate cases. Of course the old-fashioned soapsuds enema, which is somewhat irritating, or that containing glycerin, especially when taken in the knee-chest position, most invariably empties the colon. This, however, is not a method of treatment that is advised, excepting perhaps in the senile cases where its use twice or three times a week may be necessary. Occasionally the instillation of warm oil into the rectum at night (4 to 6 ounces), using Russian or the common forms of sweet oil, serves to accomplish a movement of the bowels in the morning.

Suppositories. Quite a few individuals, particularly those in whom there is no rectal reflex, can be stimulated by the use of glycerin or gluten suppository, or a small quantity of warm water containing one of these substances in solution. Soper suggests the use of magnesium sulphate solution, a twenty-five or thirty-three per cent. applied directly to the rectal mucosa or to the valves at the dome of the rectum in cases of spastic constipation, or the use of the same strength solution of sodium sulphate in the atonic type.

Medication. It is my rule to use only the mildest laxatives and they are used only in a temporary way. For the spastic form with fecal impaction belladonna may be of value. This is given as a tincture in large doses and usually pushed until the physiological symptoms are apparent.

Among the mildest laxatives is fluid extract of cascara, the aromatic fluid extract being the most pleasant to take but only about one-third as potent as the bitter variety. Phenolphthalein, in doses of from 1 to 5 grains at bedtime, may justify a trial. In my belief the combination that comes nearest to a physiological laxative is the following tablet, which goes by my name:

R	Ext. cascara sag.	2	gr.
	Podophyllin	$\frac{1}{42}$	gr.
	Ext. belladonna	$\frac{1}{16}$	gr.
	Strychnia sulph.	$\frac{1}{100}$	gr.

Sig.: Take one or two at bedtime.

The dose of cascara sagrada should be just enough to be a mild intestinal stimulant and not large enough to cause distinct colicky pain. There are some individuals who are distinctly idiosyncratic to cascara sagrada. They are usually the ones who are obstinately constipated and require very large doses to accomplish the purpose.

The author feels that it serves no advantage to include a long list of various purgative tablets or pills, most of which are well known to all members of the profession. It may be said, though, that rhubarb is an excellent drug and that the various saline purgatives which are resorbed by the stomach and upper intestinal canal and excreted by the sigmoid and upper rectal mucous membrane, may be necessary for a brief period.

Surgery. It must be remembered by the reader that the writer believes that constipation is due to some error and that he is very conservative in all matters of surgery. Surgery is never permitted in his cases unless there is a definite diagnosis of something seriously wrong, of which constipation is merely one of the symptoms. Surgery is then engaged in to relieve the condition and not for the purpose of relieving the constipation. He is not at all in favor of Lane's teachings which, while helpful in a few instances, are erroneous in by far the greatest majority. Such a thing as doing colectomies, partial or complete, because of obstinate constipation or autointoxication, is almost like beheading an individual to cure a headache.

I believe that there are instances of acute flexures or angulations of the colon or sigmoid which are important in the causation of constipation and fecal retention. I have seen a shortening of the mesentery by inflammation or adhesion, or the fixation of the gut by adhesions, cause angulation which would narrow and even obliterate the intestinal caliber. Marked redundancy of the sigmoid flexure, especially where there has been years of progressive constipation, may give rise to symptoms varying from exaggerated constipation to actual obstruction, and surgery may be required here, regarding which the restop operation of Kellogg is worthy of serious study. Developmental anomalies are certainly at the bottom of many cases of chronic constipation, and ptosis is also a factor. It must be remembered that the various suspension operations, while valuable in properly selected cases, are disappointing in the majority. At best these fixation points that are made are unstable. Of course, where marked adhesions binding down the gut or other definite factors like that exist, constipation as well as all the other symptoms are often benefited by surgery.

Surgery may be called for in the various rectal causes of constipation. When irritability of a hypertrophied sphincter exists, the irritability of the muscle is due to ulceration or catarrhal inflammation, and much can be done by the application of hot fomentations to the lower abdomen, and the daily injection into the bowel of hot oil containing bismuth or a solution of hydrastis, boric acid, etc. Where the O'Beirne's valves are hypertrophied to such an extent that the bowel is considerably occluded their dilatation is indicated, which in my hands is best done by a large proctoscope. Where the Houston valves are markedly thickened and rigid, nothing short of a division will effect a cure. This is easily done by the use of cutting clips which divide the valves by pressure necrosis. Usually the valvotomy is followed by an immediate relief. It may be said that if the relief is not complete after doing the valvotomy alone, and resort to the employment of diet, massage, electricity or vibratory treatment is called for, the operation was not indicated. I have seen several cases of hypertrophied levatores ani muscles requiring surgery. Sometimes in hypertrophied

sphincter muscles a divulsion or dividing of the muscle is necessary. I believe, however, that the simple forms of rectal dilators answer almost as good a purpose in the majority of individuals. If the result is not accomplishable, forcible divulsion performed under nitrous oxide anesthesia is called for.

DIARRHEA.

FOREWORD.

There are a number of simple conditions which can cause diarrhea. Among these may be mentioned, acute dyspeptic diarrhea due to eating markedly irritating food substances, or perhaps the exposure of the abdomen to cold, low grades of catarrhal processes in the lower end of the small intestine and right colon, the diarrheal condition which sometimes accompanies achylia gastrica, etc. These are not considered in this connection. Those presented belong to the necrotic, ulcerative or infective processes of the intestine.

NECROTIC ULCERATIVE PROCESSES.

The usual form of simple duodenal ulcer will not be considered in this connection. It has perhaps a special etiology and peculiar clinical features which differ distinctly from the other types of necrotic ulcerative processes.

Duodenal Ulceration Following Extensive Cutaneous Burns. No very satisfactory explanation of the relationship of these two phenomena has ever been presented. Why extensive ulcerations are found in the duodenum is perhaps best explained on the basis that following burns toxic substances are secreted with the bile, which, on coming in contact with the duodenal mucous membrane, induce ulceration. When they occur these ulcers differ in many features from the common peptic duodenal ulcer. There may be one or several. Usually they are located in the inferior horizontal portion of the duodenum. Mostly they are irregular in outline and they develop from the fifth to the twelfth day after the burn. They have occurred as early as the second day and as late as the seventeenth. They are met with generally in young subjects and more frequently after burns of the

trunk rather than of the extremities. They are almost invariably fatal, and according to the Fenwicks they occur in 6.2 per cent. of all fatal burns.

Embolic and Thrombotic Ulcers. The intestines are subject to changes dependent upon alterations of their blood supply, just as are other tissues of the body. If a large vessel is occluded so as to alter materially the blood supply in a considerable portion of the intestines, some degree of gangrene is usually the process that takes place, but if smaller branches of the intestinal vessels be blocked, especially those running in the intestinal wall itself, ulceration will ensue. Perhaps the common cause of such ulcers is sclerotic changes in the intestinal wall, although occasionally they may be caused by an embolism resulting from valvular disease of the heart, or abscesses or thrombosis elsewhere in the body. In the beginning of the involvement the area becomes swollen, firm, and gray or grayish-red, and the tissues of the area soon become necrotic and the mucous membrane, with more or less of the underlying tissues, is cast off and an ulcer results. If the occlusion has been such that the entire thickness of the gut wall is involved, the ulcer is deep and may perforate although most times the ulcers are of small size and involve only the mucous membrane and submucosa. Generally they are multiple.

Amyloid Ulcers. Amyloid disease of the intestines results from the same causes that produce amyloidosis elsewhere. The condition is most often found in chronic tuberculosis, syphilis, chronic suppuration, and the various cachexias. The entire intestinal tract may be involved, but at times only the ileum is the seat of the disease. Usually all the tissues of the intestinal wall are encompassed in the process. The intestines then present a pale, shiny, translucent appearance, and on application of iodine give a typical amyloid reaction by turning brownish-red, and when subsequently treated with sulphuric acid become blue or violet. Ulcers are not uncommon, those present varying from the size of a pin-point to that of the large areas involving the entire circumference of the intestine in a girdle-like fashion.

SYMPTOMS AND TREATMENT.

It is plain that the above mentioned types of ulceration are essentially secondary processes. They are characterized by one constant feature—diarrhea—and the character of the diarrhea in any one of them is not distinctive in suggesting the presence of the particular form. The stools may be frequent and watery, and usually blood is present. In the embolic and thrombotic types bleeding is not common, and in the amyloid ulcer it must be expected that when blood is present perhaps some other form of ulceration than amyloid exists.

There is very little that need be said to control the diarrhea in these conditions. Opium may be given, either in the form of morphin subcutaneously or opium powder by mouth. Ice-bags are occasionally helpful. After the diarrhea has been on for a short time the patient loses in strength and vitality very quickly and then the sustaining measures are in order. In the embolic and thrombotic types, as well as amyloid ulcers, the treatment of the condition resolves itself into the treatment of the primary disease, and an attempt to control the diarrhea, which is best accomplished by mineral and vegetable astringents and opium.

INFLAMMATORY ULCERATIVE PROCESSES.

Catarrhal Ulcerations. The term “catarrhal ulcers” is inappropriate, but it expresses well enough the nature of a condition of ulceration occurring in conjunction with an apparent catarrhal inflammation, seen most often in catarrhal enteritis of rather long duration, and more frequently in children and young adults than in those of middle age or older. The ulcers are present in both the small and large intestine, are minute, round with very slight undulating edges. They usually involve only the mucous membrane, perhaps not going through its entire depth. In my opinion such types of ulceration are generally due to infection of the intestinal contents, often certain strains of *Bacillus coli*, not dysenteric in type; or streptococcus and even staphylococcus.

Simple Ulcerative Colitis. The condition mentioned in the above division and this one are essentially the same except that simple ulcerative colitis is a more pronounced condition. It is because no organisms of the dysenteric forms are present that this term is used. In my opinion the condition is due to a form of *Bacillus coli communis*, and, as former writings of mine on this subject strongly suggest, present forms of such *Bacillus coli* may become parasitic in nature and distinctly infectious when gaining entrance to the tissue of the mucous membrane. This pseudodysenteric type of organism is not the only one that can cause ulceration of the simple type. There are conditions, such as are represented in the saccharobutyric type of putrefaction, wherein ulceration is due to the high anaërobes, mainly the *Bacillus aërogenes capsulatus*. Sometimes those which are grouped under the *Streptococcus fecalis* seem to be the infecting organisms.

Follicular Ulcers. Follicular ulceration occurs as a result of the same condition that produces catarrhal ulceration, namely by means of the infecting organisms. Here we see solitary lymphatic follicles mainly involved in the process, which begins as an inflammation, inducing a hyperplasia of the elements of the follicles which later undergo central softening, and the production of an ulcer. When present such ulcers are often numerous, at times giving a typical honey-comb appearance to a part of the bowel. If seen before ulceration has occurred the follicles appear on the mucosa as small shot-like yellow areas. Perforation seldom occurs. The colon and lower ileum are usually the portions of the intestines affected, and the condition is quite as common in children as it is in adults, those of middle age being most often affected.

Colitis Polyposa. This is not a distinctive form of colitis with ulceration, although in some of the instances ulceration has secondarily ensued and symptoms of diarrhea developed. It is probable that these polypoid growths begin in the mucous membrane which has first been affected with a general colitis and that of their funnels, local undermining ulcers similar to those mentioned in the above conditions. Finally the polypoid growths occur as a result of a healing process.

Such growths when large enough may in themselves cause ulceration again.

Stercoral or Decubital Ulcers. These ulcerations result from the irritative action of fecal masses on the intestinal wall. They occur purely as mechanical results, or what is more probable, the mechanical injury to the mucosa and an ingression of pathogenic organisms. The condition is found in the large intestine and especially at the point where stagnation of the fecal current occurs—namely at the hepatic and splenic flexures, or in the rectum, sigmoid, cecum, and appendix. The ulcers usually are simple and have an inflamed suppurating base. The condition is more frequently met with in elderly people, especially those subject to constipation. Perforation of these ulcers has been known to occur. Not infrequently they cicatrize with the production of stenosis. Such stenoses have been mistaken at times for carcinoma or stricture.

SYMPTOMS AND TREATMENT.

The symptoms of these types of ulceration may be presented *in toto*, diarrhea being the main one to draw attention to the condition. There is usually considerable abdominal pain, the stools increasing in frequency, finally with mucus and blood in them. As a rule the ordinary remedies have no effect upon the diarrhea and the patient rapidly loses in weight and strength. The number of stools vary, and usually contain fecal matter. One of the surprising features of these cases is that food passes through the alimentary canal with surprising rapidity, sometimes appearing in three hours after its ingestion. Another characteristic symptom is that the symptoms are variable, at times present in an acute form, at other times quite subsided. Much depends upon the progress of the disease and the extent of involvement in the gut wall, and particularly in its depth. Usually, however, the condition is chronic, extending over years of time. It must be remembered that there are a number of types of ulcerative colitis in which the symptoms are never severe and the patient is able to go about, although frequently troubled with loose movements. Sometimes there is an elevation of one or two degrees of temperature and the

production of what seems to be a mild degree of septic poisoning.

Usually there is a feeling of general discomfort in the abdomen, especially when the diarrhea is on, perhaps more or less colicky pains before each stool. In the stercoral type of ulcer the history of constipation is obtained, followed by a diarrheal condition, generally with considerable pain and tenderness on the left side representing the sigmoidal region, or at the flexures. It is probable that some of our cases of massed adhesions of the hepatic colon and also those of adhesions of the pelvic colon on the left side are due to ulcers having been present which have healed with stenoses or pericolononic adhesions, and the mucous membrane at the same time presenting a low degree of inflammation and perhaps ulceration.

What is very important in these cases is to examine the stools bacteriologically to see whether, on the one hand *Ameba histolytica* are present, and on the other whether the well-known form of *Bacillus dysentericus* exists. With these being absent the endoscopic examination of the rectum and lower sigmoid, when possible, is important. In the proctologic examination some idea may be gained of the size and depth of the ulcer and the character of the inflammatory process, that is, as to whether it is entirely superficial or whether perhaps it has extended through the mucosa, representing the more resisting type. Careful examinations of the stools should be made, especially as to the bacteriology which characterizes the subject of the indolic and saccharobutyric types of chronic intestinal toxemia. Where a high anaërobic infection exists a meat diet is in order, such as is represented by the following:

This diet is a temporary one. Take mostly meats—all forms of beef with the exception of cuts from the shoulder, kidneys and liver. The same is true of lamb. These meats should be fresh and taken in a broiled or roasted state. Mutton is permissible, but no pork nor veal. May take any kind of fish broiled or boiled with the exception of shad roe and shell fish. May eat eggs in any form. Butter and whole milk are allowed, together with any form of simple cheese of the cream variety, such as Philadelphia, Neufchatel and cream cheese. Eat as much gelatin foods as possible. Oatmeal and rolled oats are allowed. May have breads or crackers made of gluten or rye flour. Lentils and dried peas are per-

missible. There is no objection to an occasional orange, pineapple or strawberries. The best drink would be chocolate or cocoa.

When on the other hand the condition is due to the pseudodysenteric type of colon bacillus or due to the streptococcus, a vegetable diet represents the best form of constant treatment. It is advisable in some of these cases to roughen the diet with considerable cellulose and treat the case as one of constipation. I am not speaking now of stercoral ulcer, in which such diet would be definitely indicated, but of the coli infective forms.

It is best to begin the treatment by a rest in bed and the use of large doses of bismuth subgallate. During this time the diet should be bland, consisting essentially of a lactofarinaceous dietary. At times small doses of an opiate are useful, the best form being Dover's powder.

After many years' use of the various forms of rectal irrigation and the use of different solutions, including those of various silver preparations, I have quite given up this entire line of treatment. In such cases, however, I am not averse to the use of transintestinal lavage for the purpose of cleaning out the irritating content of the intestinal canal, in which a hypertonic solution of sodium sulphate and sodium chloride is employed, the irrigations being given twice or three times a week. Of late, also, I have used the various dyes—gentian violet in the high anaërobic infections, mercurochrome 220 at times, and neutral acriflavin in those due to the *Bacillus coli* infections. Much benefit at times may be accomplished with the use of the *Bacillus coli* subcutaneously, preferably the autogenous type. When these are employed it must be remembered that to effect the colon beneficially, large doses are necessary.

Patience and time are important essentials to remember in the handling of these cases, because often they are as discouraging to the attendant as they are to the patient. Sometimes when one considers the local condition improved an acute manifestation may take place which changes the happiness all around. It may take years of careful attention before the individual is entirely well. Care should be taken that they do not eat injudiciously, do not become chilled in the summer or get too cold in the winter; that they have

frequent sojourns in the country, and that they live normal lives without excesses and so on. These people usually possess a lower vitality and a very susceptible colon. Even after the ulceration is healed and has remained healed for a length of time, there is a friability of the mucous membrane which seems to be ready to break down on the slightest provocation. Therefore, it is well to apprise these people of the fact that they should not be discouraged even at an acute exacerbation, and that it sometimes takes a long time before a cure can be brought about.

In my experience when marked follicular ulcerations have existed which have undermined the mucous membrane or when polypi are present, a cure is practically never accomplished by medical means alone. It is in these types of cases that appendicostomy or cecostomy, in addition to the above-mentioned methods of treatment, are usually required. After irrigation, for a number of months many of these colons take on quite a normal aspect. But again it should be mentioned that after the fistula has healed and no further irrigation from the head of the colon downward is possible, we not uncommonly see a return of the condition. Thus it serves to good purpose here to remember that the medical measures of treatment should be carried out even though an operation has been performed.

INFECTIVE ULCERATIVE PROCESSES.

TUBERCULOUS ULCER, STENOSING TUBERCULOUS ENTERITIS AND CHRONIC HYPERPLASTIC TUBERCULOUS ENTERITIS.

Tuberculous ulceration of the bowel may occur as a primary infection, although it is most often secondary. Evidently tuberculosis of the digestive tract is more common in children than in the adult, and it is not uncommonly found left from other infectious diseases, particularly fevers. Most of the instances in which intestinal tuberculosis is met with are those of pulmonary tuberculosis, the intestinal lesion usually resulting from the swallowing of the bacillus-bearing sputum.

The most common lesion of intestinal tuberculosis is ulceration. It occurs most often in the ileum, just above the

ileocecal valve, although they may occur as high as the duodenum and as low as the rectum. These lesions begin as a small gray nodule just below the mucous membrane. This nodule enlarges and undergoes caseating degeneration in the center. Observed microscopically, it will be seen to consist of a number of typical tubercles composed of giant, epithelioid and lymphoid cells, or of a diffuse caseating mass. Finally, the nodule breaks through the overlying mucous membrane, the caseous material is discharged into the bowel and tuberculous ulcer results. The extent of the ulceration varies greatly in different cases. Ulcers of varying size and age will be found in the same case. Complete healing with the disappearance of all tubercles is an unusual occurrence. Not infrequently, however, the ulcers undergo partial organization, so that while some ulceration remains, a moderate degree of stenosis is also present. Most practitioners are aware of the well-known form of ischiorectal abscess presenting in tuberculous individuals. In these instances it is probably due to an ulcerating process causing an abscess external to the coats of the rectum. While the occurrence of an ischiorectal abscess should not be taken in any sense as diagnostic of the presence of tuberculosis, the clinical fact remains that an association between ischiorectal abscesses and tuberculosis has been established. Of course in this instance tuberculosis was present before the ischiorectal abscess occurred.

Symptoms and Diagnosis. The symptoms of ulcerative, tuberculous enteritis do not differ materially from those of simple enteritis or of other forms of ulceration of the bowels, excepting in the fact that they are chronic. The most constant and characteristic symptom is diarrhea; although this is by no means always present even when the ulceration is extensive. When present, the stools are soft and unformed, or they may be thin and watery. Mucus is usually present in small masses or as strings or shreds. Not uncommonly there is an admixture of blood in small quantities, and not uncommonly small hemorrhages take place. There is probably no one condition that causes a more rapid emaciation of a tuberculous patient than the establishment of a tuberculous enteritis with diarrhea. The individual loses strength rapidly

and not uncommonly takes on quite a septic look, this being distinct even though a pronounced pallor also exists. A striking feature in these cases is a soreness, localized tenderness which usually is not very marked and which generally exists in the right iliac fossa. In every case of marked tuberculosis of the lungs where there is a tendency for looseness of the bowels or the establishment of a diarrhea, the movements of which are generally preceded by attacks of abdominal pain, the abdomen taking on a rounded contour and perhaps some bulging on the right side, always suspect the presence of ileocecal tuberculosis, because it is a clinical fact that it is present in perhaps fifty per cent. of pulmonary tuberculosis cases, whether abdominal symptoms are present or not. At the same time it must be recalled that amyloid disease of the intestines, the most prominent symptom of which is diarrhea, is a common complication of tuberculosis. In amyloid disease there is usually a more watery discharge from the bowels than in instances of tubercular enteritis and it is less commonly associated with occult or visible blood.

Treatment. The prevention of intestinal tuberculosis is to some extent possible in the way of controlling the swallowing of infected sputum in tuberculosis cases. It is for this reason that the so-called sputum cup has become so popular, because it is a well-known fact in sanitariums that when patients develop ileocecal tuberculosis the end is usually not far off. Once the condition has occurred, the main purpose of the treatment is to save the patient's strength by controlling the diarrhea and as far as possible the ulceration itself. As has been stated before, there is some tendency of these ulcers toward healing, although usually with our best efforts very little can be accomplished in positive ways. It has been suggested that the diet should be regulated and that this is an essential part of the treatment. In my experience it makes no difference what the diet is, and I have tried all forms but have never been able to convince myself that any form possesses any value worth while in these cases. It is a wise thing, however, to remember that raw milk usually does increase the abdominal distress, whereas, on the other hand, milk which has been thoroughly boiled does not do this and seems to act in a beneficial way.

As far as medication is concerned, I have never been able to satisfy myself that except in the use of opium and large doses of the various bismuth salts much worth while is accomplished. There have been some cases in my practice that have done well on small sized doses of beechwood creosote taken in the form of enteric pills after the meals, usually two grains at a dose. Sometimes small doses of dilute hydrochloric acid in conjunction with essence of pepsin given before the meals, serves to some value. The majority of these individuals have a gradual loss of gastric juice, due to the effect of the fever upon the secretory apparatus of the stomach, this fever being due to the pulmonary tuberculosis. An occasional irrigation of the colon, sometimes a transduodenal lavage with acriflavin, will work very magically for a short period of time. It must be manifest to the reader that the control of the abdominal condition is very largely subservient to such benefit as can be brought about in the control of the tuberculosis in a general way. This requires attention to those things which are beneficial in tuberculosis, namely rest, sufficient food, fresh air, sunshine, isolation from business, etc.

SYPHILITIC ULCERS.

In acquired syphilis a low degree of enteritis occurs at times. This may go on to the establishment of considerable pathology of the gut, due to multiple gummata with the pathology mentioned in the foregoing in connection with the various types of ulcers. Perhaps the most frequent situation of syphilitic ulceration of the intestines is in the rectum, and these ulcers are distinguished from those of dysentery by their smooth, gray base and the tendency to induration of the edges and extensive stenosis.

It is probable that stenosing tuberculous ulcers of the rectum have been frequently taken for syphilitic lesions, and *vice versa*.

The *symptoms* are those of intestinal ulceration or stricture and permit a probable diagnosis only on the basis of the history or the associated findings of syphilis, and perhaps their response to the therapeutic test, or to the Wassermann reaction. Always suspect in a young woman who

has a stenosis existing low in the rectum that the lesion is syphilitic in nature.

The *treatment* of syphilis of the intestines is directed to the general infection and to the control of the diarrhea. The latter often persists in spite of ordinary treatment and even after active antisyphilitic remedies have been employed. In my experience the best remedy to use in syphilitic involvement of the gut is salvarsan or neosalvarsan in intravenous injections. Mercury and the iodides may be used in addition. The point to keep in mind is that the treatment must be active and most energetic, or no results will be accomplished. In the presence of stenosis operation may be in order.

SPRUE (DIARRHEA ALBA).

The true etiology of this disease is still somewhat in doubt, although it seems to be settled by Ashford, who in 1915, under the term of *Monilia psilosis*, described an organism which seems to be the offender. It is an old disease, having been known as far back as 1776. Usually it is found in tropical countries and it is characterized by the passage of large, frothy, pultaceous, light-colored stools, associated with atrophy of the mucous membrane of the alimentary canal and later of the liver, and raw or ulcerated tongue and mouth, commonly ending fatally after a running and protracted course. The most important changes are met with in the intestinal canal, where the mucous membrane of the small bowel is thinned, and on section shows extensive atrophy of the villi and tube glands, together with small round celled infiltration. The condition seems to be due to a chronic infection of the whole lining of the alimentary canal going on to atrophy of the mucous membrane.

Symptoms. This disease is common in the latter part of the year, particularly after the conclusion of a rainy season, although it is met with at all times. It occurs in individuals most often between thirty and fifty years of age, and it may therefore be said to be a disease of middle life. It is more common among the whites than the mulattoes, and among the true negroes it seems to be rare.

The onset of sprue is usually that of a severe type of indigestion, regarding which the diagnoses of gastroenteritis, acute duodenitis, gaseous indigestion, represent the largest number made. Almost a third of the cases, however, have no symptoms at the beginning. In other cases the symptoms may run along for a while, there being no suspicion of the condition. Gradually, however, a chronic fermentative type of indigestion occurs in which the intestinal symptoms take place, usually preceding an infection of the tongue and mouth. The first sign of the disease is usually an irregularity of the bowels, thought to be due to some simple form of diarrhea, but tending later to occur in the morning and to become chronic, while the stools become light-colored and bulky, and the dyspeptic symptoms increase. A steady loss of weight now occurs with perhaps an occasional temporary improvement, a sallow complexion and in the latter stages anemia ensues, and after a longer or shorter course a large proportion of the cases eventually terminate fatally or in chronic invalidism, predisposing to the supervention of terminal acute infections. These usually take years to bring about.

Diagnosis. The diagnosis of sprue is not difficult in the typical case, although it is very difficult in the early stages. The success of treatment depends upon early diagnosis and it is well to look upon any case in a sprue country, that has chronic diarrhea with light-colored stools, deficient in bile, as likely to be that of the early stage of the disease. Of course when the mouth symptoms are present they have special diagnostic importance, but their prolonged absence in no way negatives a diagnosis of sprue. The character of the stools usually enables the disease to be detected early, whereby appropriate and timely treatment can be adopted and perhaps the disorder cut short before the patient becomes a confirmed chronic case. It is stated that in the chronic cases at least two-thirds receive no benefit from whatever form of treatment, whereas, those treated carefully in the first six months of the disease yield much better results. This is important because the rate of mortality in sprue is high—as much as eighty per cent. in the chronic cases.

Treatment. The treatment of a well-established case of this condition is unsatisfactory. Many remedies have been advocated for it, none of which can be relied upon to give uniformly good results. Of value, however, is the regulation of the diet, and in some cases the fewer medicines by mouth the better the chances of improvement. All irritating forms of medication usually do more harm than good. Some benefit is found by the use of small doses of ipecacuanha, $\frac{1}{6}$ to $\frac{1}{3}$ of a grain of emetin hydrochloride, hypodermically given once a day.

The most important item of the treatment is the regulation of the diet. A purely milk dietary is generally most useful, gradually increasing the quantity until four to six pints are consumed in the twenty-four hours. The milk may be diluted with various substances. In other cases a meat diet is more successful and should be substituted for milk if the latter is found after a careful trial not to suit the patient. Owing to the deficiency of carbohydrates in meat it is necessary to push the quantity up to two pounds in a day, including as little fat as possible, as the latter is not easily digestible. Beef and mutton are the best forms, but chicken has often been relied upon in certain locations. In advanced cases extracts of meat and raw meat juice are necessary. As improvement in the stools takes place and weight is gained, the diet may be cautiously increased by the addition of eggs, fish and some fruit. In certain parts of the world fruit, in addition to milk, has been strongly suggested as a dietary in sprue, grapes having been given much on the continent. The difficulty in all dietetic treatments of sprue is to induce the patients to continue them long enough to allow for full recovery of the damaged mucous membrane, and until the stools remain formed and contain sufficient bile, weight has been gained, and the symptoms subsided. It is also advisable for a patient to be taken to a cold climate, preferably one which is dry.

BACILLARY DYSENTERY.

Distinctly a disease of middle life is this condition of world-wide distribution and is apt to occur in epidemics, thus differing from amebic dysentery. Marked epidemics of

this condition have occurred in the sixteenth, seventeenth, and eighteenth centuries, and from time to time it is met with in various parts of the world. It is very common in Egypt and is often found in America, particularly in the southern part of the country. In recent years investigation has proven that dysenteric infections occur in the young, but these are usually in a modified form although the organisms are identical with those infecting the adult human being.

Etiology. Agata, Shiga and Kruse proved that the bacillus was a specific one, which now is known as the *Bacillus dysenteriae* of Shiga and Kruse. Shiga found it in almost pure culture in the blood-stained mucus passed in the early stage of acute dysentery, and he showed that on recovery it disappeared. He also demonstrated it in post-mortem lesions in an agglutination reaction of the blood serum, and he was enabled to produce dysentery in animals by inoculation with this bacillus. Kruse substantiated these results with his bacillus. Soon after that Flexner also isolated a bacillus in the United States which was the same as the Shiga bacillus. Since that time the dysentery bacillus has been found in various parts of the world and has been described by various observers under various names.

Organisms have been isolated which have been given the name of paradysentery or pseudodysentery bacillus. It must be remembered, however, that slight differences do not necessarily mean different organisms. They may be only races, and it further has been shown that by prolonged subcultures new sugar fermenting properties can be developed, such differences being usually taken to be characteristic of new species.

The bacilli taken as a whole are somewhat short and thick, being about 1 to 3 μ long. They may show variation in shapes according to the culture medium employed and the age of the culture, involution cocci-like forms occurring. None of these organisms produce gas. This differentiates them from the coli group. Their action in splitting up the various sugars serves for differentiation among themselves as a group. In a bouillon they all produce turbidity, and after two or three days a precipitate is formed. The growths on agar present appearances similar to gelatin cultures, be-

ing white, moist, and more or less iridescent. Mannite is the most important sugar, as it divides the bacilli into two groups, the mannite fermenters which form the greater number, and the mannite non-fermenters, represented almost exclusively by the Shiga-Kruse bacillus, which is thus clearly differentiated from the others. The following is a table showing the principal sugar reactions of the four important bacilli:

	Mannite	Maltose	Saccharose	Dextrose
Shiga-Kruse	O	O	O	O
Flexner Manilla	F	F	F	F
Strong	F	?	F	O
His's Y	F	O	O	O

F stands for "ferments" and O for "does not ferment."

After a certain number of days from the commencement of the disease, specific agglutinins appear in the blood, and by means of the Widal reaction a diagnosis of bacillary dysentery can be made, and not only of dysentery but of the particular variety of bacillus as well. This reaction usually does not take place before the seventh day, and it is not often delayed beyond the twelfth day, though in some cases it may not be found before the third week. Shiga, in his researches obtained from agar cultures a toxin which produced lesions in the intestine, as a rule without diarrhea, and which produced, in addition, wasting and paralysis. It has been found that a powerful antitoxin could be prepared by the immunization of horses either with the soluble toxin or with the bodies of the bacilli. This toxin is comparatively stable, and is not destroyed by heating at 70° C. for one hour. The difference in the susceptibility of different animals to the toxin is very striking. Antitoxin is most readily produced by the Shiga-Kruse bacillus, and, as but little toxin is produced by the Flexner type, this organism probably does not lend itself to the antitoxin treatment, although there are some who believe that it does. A passive immunity can be produced by the injection of an antitoxin but an active immunity is only produced by a vaccine. It is by such a proceeding that the antitoxin sera are produced. Thus

it is that Ludke, bearing in mind Wassermann's experiments with autolysed typhoid bacilli dried and kept *in vacuo*, which were found to keep well, produced a high degree of immunity with the bacillus of dysentery without much pain or reaction. He prepared a vaccine which he considered superior to the sensitized vaccine.

Pathology. In the acute form of bacillary dysentery the whole of the large intestine may be involved and the disease may attack the lower part of the small intestine as well. Generally the mucous membrane as a whole becomes swollen, red and very vascular. It may be covered by a whitish mucoid exudation, this exudation sometimes resembling the membrane of diphtheria. The edges of the folds may show superficial ulceration or erosion; in a more advanced case the mucous membrane may become gangrenous and large areas take on a greenish-black appearance, and on the separation of the sloughs serpiginous ulcers are formed. There is this radical difference between the amebic and bacillary dysentery, that in the former the disease is essentially one of the submucosa and isolated ulcers appear with healthy areas of mucous membrane between them, whereas in the latter the involvement is from the surface and healthy areas are not seen between the lesions. In convalescent cases healing ulcers are found which leave in many instances a pigmented scar. The disease may in some cases, instead of being completely cured, become chronic; under such circumstances, the lower part of the large intestine and rectum are chiefly involved. The ulceration may last for months, and may end in stricture of the gut, although in my experience it usually continues as a subacute condition. The lesions are best discovered clinically by sigmoidoscopic examination.

Symptoms. The incubation period is generally short, three to six days being the average. The onset is sudden, the patient being seized with severe pain and colic in the abdomen. This is quickly followed by a constant desire to defecate. The motions quickly become small and may consist after a while of slight evacuations of blood and mucus. They may number twenty or more in the twenty-four hours. The tenesmus may be very severe owing to the early involvement of the rectum in this form of dysentery. The abdomen may

be uniformly tender. With such a typical acute case there is usually a rapid rise in temperature. The thermometer may register 104° F. This temperature may persist for several days with fluctuation and it is seldom as steady as it is in typhoid fever. Toxic symptoms usually rapidly appear, the patient becoming drowsy and listless, especially in the case of children, and exhaustion may set in quickly from the constant pain and tenesmus, the patient being very unhappy unless he is constantly on the bed-pan. The pulse rises, the tongue becomes coated and may become dry. Albumin may appear in small quantities in the urine. In bad cases vomiting sets in. If the disease persists in this acute form the patient becomes very feeble, with pinched features, dry, inelastic skin and a small rapid pulse. In favorable cases the symptoms gradually disappear. The temperature becomes normal, and in ten days to a fortnight convalescence is established. Relapses may occur. In a few cases the condition may become chronic. In this last instance, the typical dysentery bacillus may disappear, and other forms—such as the streptococci or groups of the *Bacillus coli*—become semiparasitic in the gut.

Chronic bacillary dysentery, as identified by obtaining the specific organism in the stool, is rare in ordinary civil life but does occur. That most often seen is a direct sequel to the acute form. This is in contrast with the amebic type, which may be chronic from the beginning. There is little or no temperature, but the stools continue to be somewhat frequent. There may be tenesmus with blood and mucus. Emaciation is a frequent sign. It may persist for years and eventually cure may result, but with a strictured gut and a ruined constitution. The stools sometimes contain in this form bodies like frog-spawn or sago-grains.

In its more chronic form bacillary dysentery is much less characteristic than in its early acute manifestations. Sometimes it is impossible to differentiate it from amebic dysentery by purely clinical appearance. As a general rule bacillary dysentery terminates in either death or recovery in a few months, and comparatively rarely lingers on with longer or shorter remissions for from one to several years, as is not uncommonly the case with inadequately treated amebic

disease. Nor are the remissions so complete and lengthy in the bacillary type, the disease tending to run unchecked until the patient eventually develops some immunity to the infection and slowly recovers. More often, however, the patient becomes worn out by his sufferings and the steady loss of albuminous fluids in the bowel discharges, and succumbs to exhaustion. Extreme emaciation with a retracted abdomen is a striking feature of the clinical picture, but in the terminal stages it may be partly masked by dropsy due to cardiac weakness, atrophy of the general muscular tissue, and anemia. Severe hemorrhage from the bowel is less common than in the amebic form.

The two most common *complications* of bacillary dysentery are hepatitis and arthritis. Hepatitis going on to suppuration is a very common remote complication of amebic colitis, and it might at first sight be expected that acute and chronic bacillary ulceration of the large bowel might frequently result in infection of the liver through the portal system. Comparatively it is very rare. Portal pyemia with multiple small abscesses of the liver may occur as a complication of bacillary dysentery, but this also rarely happens.

The complications of bacillary dysentery are not numerous. Hemorrhage from the bowel is rare. Heart affections may occur as the result of the toxemia, dilatation of the heart may occur, myocarditis has been recorded, and irregularity of the heart's action with tachycardia is not uncommon. Joint affections, usually taking the form of a troublesome synovitis, usually of the knee, is a late toxic manifestation. Iridocyclitis may exist. Neurasthenia may result but other nervous manifestations, such as poliomyelitis, are extremely rare. Perforation of the bowel and peritonitis are also rare, and so is liver abscess. If abscess occurs it is of pyemic origin.

Treatment. Unfortunately we have no drug with a specific curative action on bacillary dysentery such as ipecacuanha has on the amebic disease, so, apart from diet, the serums, vaccines, and use of the various dye solutions, the treatment is largely empirical.

In the acute cases coming early under observation, the first thing to do is to clear out the bowels with a purge,

of which castor oil is the best. After the purgation the patient is kept on a fluid diet, composed mainly of citrated milk, during which time the stools are examined bacteriologically. In very mild cases of dysentery treated as soon as the first symptoms appear, it is surprising how quickly all traces of mucus disappear from the watery yellow stools, while at the same time relief is afforded to the abdominal pain and tenesmus. Opium is often necessary if the stools continue to be frequent and distressing, and especially helpful if abdominal pain is present in the intervals between the evacuations. It is best given in the form of an enema but may be taken with calomel. Solutions of permanganate of potash which are supposed to have an immediate action on the toxins produced by the Shiga bacillus, oxidizing them into harmless substances, have been advocated. Rogers suggests the use of the calcium salt of permanganate as preferable to the potassium one, as the former is less irritating to the bowel.

Since bacillary dysentery is largely an infection of the colon it seems reasonable to expect a benefit from the use of the transintestinal lavage in which a hypertonic solution of sodium sulphate and sodium chloride is employed. This should be given early and repeated each day, until a thorough purgation and a flushing of the bowel has taken place. After the subsidence of the acute symptoms, to prevent the chronic form from occurring of that diarrheal condition that is due to the organisms of a mixed infection, the use of the hypertonic solution may be discontinued and neutral acriflavin used. This may be employed in plain solution usually in quantity of about five hundred to one hundred cubic centimeters, and if the amount given is large enough the fluid is voided by rectum in about from one to two hours. Dye solutions may be used, such as mercurochrome 220 and gentian violet, but my experience has been that in subacute dysentery, as well as in those forms due to a mixed infection, neutral acriflavin acts to the best purpose.

Of late much interest has been attached to the use of serum in the treatment of this disorder, especially in the acute stages. It is made by repeated injections of the Shiga bacillus toxins in gradually increasing doses into horses over

a long period. The main difficulty with regard to this treatment is that there are a number of varieties of dysentery bacilli in different countries, and different outbreaks in the same country. Thus, Ruffer and his colleagues found it necessary to make a polyvalent serum with the aid of dysentery bacilli isolated from cases from different sources, and with it they obtained remarkably good results in the severe and neglected cases among the Mecca pilgrims, in which the death rate in bacillary cases was reduced from over sixty-four per cent. to slightly over ten per cent. This serum is said to be most effective when administered intravenously. It is obtainable in the American market and has only been employed subcutaneously in my practice. My experience with it has been limited and I am not prepared to make any statements as to its value. I do know, however, that in the latent infection following dysentery the serum is of no value.

In established chronic bacillary dysentery the treatment is much more difficult and unsatisfactory than in the earlier stages. The reason for this is because the bacteria have worked their way into the depths of the mucous membrane, the organism culturizing there. Frequent transintestinal lavage, with perhaps dye solutions, answers to good purpose here. It is in this form of bacillary disease that the astringent enemata are most valuable, the best being a solution of silver nitrate of about one pint, the strength of the solution being about one-half to one and one-half grains to the ounce. Copper sulphate, in a strength of one grain to the ounce, is often of great value.

Shiga first injected the dead dysentery bacilli as a prophylactic against the disease. Other observers have used similar procedures. The value of vaccine treatment in bacillary disease is still a debatable ground, although the consensus of opinion of those who have had the most experience with it is in its favor. The vaccine most often used is that known as Forster's. The initial dose for an adult should not exceed one lethal dose for a rabbit.

In the chronic forms of the disease dieting is very important. The patient should be kept in bed, or at least free from activity, the diet to be largely a milk diet for a space of time, the milk preferably being boiled. By this, with

large doses of bismuth by mouth (the subgallate salt being preferable), the stools are generally rendered pasty. Slowly the farinaceous foods may be added, preferably those that have been well-boiled, then the large carbohydrate-bearing vegetables, and, with the stools continuing satisfactory, small quantities of scraped meat or picked fish are to be added. One should be very careful not to add largely of cellulose to the diet and not to resort to protein feeding too quickly. The patient should be kept comfortable and under the best hygienic conditions possible. A prolonged sojourn in the country where the atmosphere is cool and the conditions favorable is often most advisable. There should be freedom from work, excesses of all kinds, mental strain, etc. Great care should be taken that the abdomen does not become chilled, or the general body overheated. Under ideal conditions the patient usually improves, often with small remissions which are easily controlled, and after a few years appears to be well. It is important to remember, however, that many of these individuals seem to have a friability of the colon, and under the merest provocation therefor have a remission.

PHLEGMONOUS ENTERITIS.

This disease is probably never met with as a primary process. The organism most commonly found in phlegmonous gastritis and enteritis is a streptococcus.

CHOLERA ASIATICA.

This is an infectious disease, caused by the comma-bacillus, and characterized by violent diarrhea and rapid collapse. The cases are mostly met with in eastern countries but the condition has been known to occur in America.

The disease is due to a specific organism described for the first time by Koch. In the characteristic case they do not occur in the vomitus, but are met with in post-mortem examinations in enormous numbers in the intestines. They are found in the depth of the glands and in the still deeper tissues. The bacteria have toxic properties, even in dead culture, and the symptoms, which occur very rapidly, are no doubt also due to an absorption from the intestine when

the epithelial layer has been injured. It is propagated chiefly by contaminated water used for drinking, cooking and washing; its dissemination is due to so-called cholera carriers which are probably even more numerous than typhoid carriers.

Symptoms. After a period of incubation for from two to five days, the disease sets in with a preliminary diarrhea, and colicky pains in the abdomen with looseness of the bowels, perhaps vomiting, headache and depression of spirits, without fever. This diarrhea increases or it may set in acutely without preliminary symptoms until profuse liquid evacuations succeed each other rapidly. Exhaustion and collapse soon occur, with extreme thirst, the tongue becomes white, and cramps of great severity occur in the legs and feet. Within a few hours vomiting sets in and becomes incessant. The patient goes into collapse, the extremities are cyanosed, and the appearance is that of a dehydration of the body. Usually the surface temperature is below normal while that of the internal parts may be as high as 103° to 104° F.

At first the feces are yellowish in color, but soon become grayish-white and look like turbid whey or rice-water, whence the term "rice-water stools." In such discharges there are numerous small flakes of mucus and granular matter, and at times blood. The reaction is usually alkaline. As a rule this stage usually lasts for from twelve to twenty-four hours. If a patient survives the collapse, a gradual return to normal condition takes place, although some of them go into a condition known as cholera-typhoid, in which death occurs with coma, the symptoms being attributed to uremia.

Diagnosis. The only infection with which Asiatic cholera could be confounded is with cholera nostras, a severe choleraic diarrhea which occurs during the summer months in temperate climates. The absence of an epidemic, the extreme collapse and vomiting with rice-water stools, the cramps, the cyanosed appearance, may be helpful, although in severe cases of cholera nostras most of these symptoms may be present. The main distinction, however, is by bacteriological methods in the discernment of the specific organism in the bowel discharges, there being no specific organism as a cause of cholera nostras.

Treatment. Preventive measures are all-important. The isolation of the sick and disinfection of discharges have eventually prevented the disease entering various countries, and accomplished its control in countries in which it was endemic, such as India and the Philippines. All fluids should be boiled, errors of diet avoided, and digestive disturbances treated promptly. The patient should be kept at rest in bed, warm, and given a simple diet, boiled milk, whey, and egg albumin. Large quantities of water should be given, as well as hypodermoclysis, to overcome the dehydration due to the diarrhea and vomiting. Calomel and opium are the most efficient remedies to control the diarrhea and pain.

GASTROINTESTINAL INFLUENZA.

This is a pandemic disease occurring at irregular intervals, characterized by the large number of people attacked. It is supposed to be due to a special organism, namely, the *Bacillus influenza*, although of late the specificity of this organism has been questioned. Numerous pandemics since the sixteenth century have occurred. The disease is highly contagious, and seen in its most severe forms in the cold season of the year.

Symptoms. The period of incubation is from one to four days, the onset abrupt with fever and its associated phenomena. It is not the purpose here to describe the respiratory, nervous, or so-called febrile forms, but simply the gastrointestinal.

This occurs with an onset of fever and more or less vomiting and nausea, or the nausea and vomiting may not be present, the attacks being ushered in with acute abdominal pain, profuse diarrhea and collapse. In some epidemics, jaundice, probably due to an extension of a catarrhal process up the common bile duct, has been a common symptom. Usually there is an enlargement of the spleen depending chiefly upon the intensity of the fever, and while this form is supposed to be rare in the United States, I have met with it often enough to say that in an epidemic it is more common than believed.

Treatment. Isolation should always be practiced, even with gastrointestinal form, and while no work has been done

to recover the characteristic type of bacillus from the stool, it is best to consider the discharge as infective, and thus its sterilization is in order. From the onset the treatment should be supporting, the patient kept in bed, carefully fed and nursed. The bowels should be kept open by the use of calomel, and Dover's powder may be employed to control the distress and diarrhea. The patient should be kept well warmed, and if the fever be high, aspirin given. Where cardiac weakness occurs, stimulants freely given are in order, and during convalescence strychnin in full doses, or the use of thyroid extract. Even after the gastrointestinal cases the convalescence may be protracted into weeks or months before full health is restored. Thus a good nutritious diet, change of air, and pleasant surroundings, are essential. Low spirits and general weakness following this disease is one of its characteristic features.

CHRONIC EXCESSIVE INTESTINAL TOXEMIA.

(PUTREFACTION, INDICANURIA, AUTO-INTOXICATION,
OR INTESTINAL FOOD-BACTERIA TOXIC STATES.)

FOREWORD.

In diseases of middle life there are no more important conditions which are etiologic in the production of disease or strongly contributing factors in them than chronic intestinal toxemias. These conditions present, perhaps, the most important of all subjects we have to consider and they are especially interesting when found associated with diseases that ordinarily are classified as of obscure origin. Leaving out of consideration the effects of syphilis, hereditarily acquired endocrine disorders, various chemical toxemias (such as plumbism, chronic alcohol or nicotine poisoning), the conditions and diseases of obscure origin are the most common we have to deal with in middle life. Long-standing infections, such as focal, tuberculosis, etc., assuredly may bring on destructive effects in the protoplasm of the parenchymatous cells of various highly specialized organs, but the largest and most common source of focal infection

in the human economy is the intestinal canal, a portion of medicine so large and significant that it is a wonder that it is so little touched upon by scientific and practical physicians. This is especially surprising in that the most complete mortality records show that in the last twenty years the only reduction that has taken place is in infancy and childhood, and not at all in the middle decades of life. Middle age, the most important of all stages of life from economic and progress standpoints, deserves that biologic errors of intestinal digestion receive more attention from the profession than they have given to them. Much of the work that has been done in this connection has been of the rash assumptive order, usually based upon some simple laboratory procedure. These have been applied to practical medicine with a degree of enthusiasm not warranting the clinical results possible of attainment, and the same may be said of the many physical treatments, especially the enemata and irrigations of the colon.

ETIOLOGY.

In 1887 Bouchard advanced his theories on auto-intoxication of the intestinal canal in an interesting work which is now quite out of date. Following him, Metchnikoff, who may be considered the real founder of what may be called the school of intestinal toxemias, drew attention to the colon being a breeding place for pathogenic bacteria and advanced the Bulgarian bacillus method for treatment. In 1907 Christian Herter, who had been working for several years on the subject, engaged in a series of laboratory observations, and wrote a small-sized textbook on the subject. Following this was the work of propaganda carried out by Sir Arbuthnot Lane on stasis, ptosis and toxemia as having to do with the clinical condition, and suggested operative interference for their alleviation and cure. Various other writers engaged in the presentation of the subject, and in 1913 Kellogg published papers attempting to demonstrate practically all of the list of diseases which Lane claimed to be due to intestinal toxemias were due to incompetency of the ileocecal valve. In 1913 Martin, of Philadelphia, and myself proved that Lane and Kellogg were wrong and that no operative interference

was warranted on the intestines in these conditions unless bona fide obstruction existed. Goldthwaite advanced the anatomic and mechanistic causes of practically the same list of disorders that Lane had given. Of much interest in this connection, however, were the writings of Adami in 1899, on "Latent Infection" and "Subinfection," in which he drew attention to the fact that submucosal infection could exist, it being an old observation of mine as well as of E. E. Smith, of New York City. In 1910 I advanced a method for the treatment of intestinal toxemias by means of rectal administration of autogenous *Bacillus coli*. This was added to by Satterlee, who suggested their subcutaneous use in the ordinary forms of vaccines. In 1920 the various bacterial methods which I employed were then given to the profession in the text-book on intestinal diseases.

PATHOLOGY.

It can be deduced and believed that chronic excessive intestinal putrefaction and fermentation may be divided into two classes, the primary and the secondary. The primary ones are those which are due to definite infective conditions running chronically in the intestinal content and in the gut wall, while the secondary ones are those which are due to disorders which unfavorably influence the status of affairs in the intestinal canal and bring on the toxemia in a secondary way. From bacterial changes in primary intestinal toxemias there develops a degeneration in the sympathetic fibers between the muscle planes which may extend into the sympathetic paths extra-enterically, even as high as the sympathetic plexuses in the back of the abdomen. When enough degeneration has taken place, dilatation of the viscus which is supplied by these sympathetics occurs, and atony with stasis is the result. Such may cause a sagging of heavy organs which further add an item of delay.

Toxins formed in the bowel may conceivably be of four types: *First*, products of disintegration of foodstuffs by the digestive juices; *second*, products of disintegration of foodstuffs by bacterial activity; *third*, the ectotoxin discharged by the intestinal bacteria; and *fourth*, toxins from the dead bodies of bacteria. In regard to the first type, peptones,

proteoses, etc., from proteid digestion are toxic only when introduced directly into the blood or tissues. It has been stated that these could not act as toxic bodies and that if they were introduced, which is not possible since they are not absorbed unchanged by the healthy bowel, only anaphylaxis could result. It is well to remember, however, that in the presence of acids various monamino acids and diamino acids or hexone bases are formed and these may easily gain entrance into the general circulation. Somewhat the same bodies are formed in laboratory digestion of albuminous substances. In the simple action of pepsin upon the albuminous molecules we have, in addition to the non-crystalline bodies, ammonia and the diamino acids, monamino acids, also the aromatic series such as is represented in tyrosin, tryptophan and phenylalanin, and the fatty series, leucin, glycocoll, alanin, glutamic acid. In the microbic decomposition of albuminous molecules, in addition to non-crystalline bodies is a long string of fatty series, and finally fatty bodies, such as butyric, caproic, valerianic, various ptomaines and bodies of the aromatic series such as oxyacid group, the phenol products, the indoxyl products and various gases, all of which are toxic. Albuminous putrefaction occurs mostly in the large intestine, in which the reaction is more or less alkaline. Hence it is that normally the fermentation of the carbohydrates takes place in the small intestine and the putrefaction of the nitrogenous bodies occurs in the large.

Whenever the fatty acids accumulate in the blood, there results an acid intoxication, or acidosis, which is characterized by a diminution in the alkaline bases of the blood. This acidosis is supposed to occur only when the fatty acids are formed in excess, and this rarely happens except under the influence of the breaking up and fermentation of the ternary bodies, and the fats in particular. For a complete presentation of the subject of the various toxins that are formed in the intestinal canal the reader is referred to my work on the subject. Intermingled with these factors of food and secretory activity is the influence of aërobic and anaërobic conditions in the digestive tract, and the nature of the bacterial activities which occur there. The initiation of putre-

factive decomposition in the digestive tract depends very largely, but probably not exclusively, on the activities of obligate anaërobes, and a portion of the digestive tract is at all times under anaërobic conditions.

If the stomach exodus is slow the chances for anaërobic development are good, and hence we frequently find that there are evidences of putrefactive decomposition of food that has been unduly retained in the stomach—namely, the presence of sulphureted hydrogen, mercaptan, butyric acid, etc. On the whole, however, in the average case of intestinal toxemia which we see, no gastric condition can be ascribed as a contributing cause, in fact many gastric conditions are secondary to intestinal toxemias. While in a few cases of intestinal toxemia it can be proven that putrefaction takes place in the lower end of the small intestine, the usual thing is that it takes place in the colon, where anaërobic conditions are more perfect. In the colon the anaërobic conditions are well maintained throughout its entire course and here we find the greatest number of anaërobes and the most pronounced evidence of putrefaction. There is, however, a gradual fall in the number of living bacteria beyond the ileocecal valve so that in the rectum the numbers of cultivable bacteria are very much less than in the ascending colon. There is evidence to prove that under certain conditions the restraint against bacteria which would be inimical to the host may be overcome by errors in diet, depressed general conditions, or alterations in the secretions of the digestive tract, and that thus definite infection by the hemiparasitic bacteria that are present becomes possible, that is, infection of the intestinal content and perhaps secondary infection of the mucosa itself.

Toward adult life great differences exist in the habits of different persons, and these are in a degree reflected in the nature of the bacterial processes of the digestive tract. In adult life there are the individual experiences, new responsibilities, new dangers, an enhanced emotional life, and often a greater proportion of indoor and sedentary habits. The dietary is apt to undergo an alteration in the direction of increased and frequently injudicious liberty and the use of tea and coffee, etc. Also the use of tobacco and alcoholic

drinks is either increased or begun. It is not unusual to find people who are over fifty years of age and apparently robust and well, who possess a slight degree of inability at work, and at times feel tired. With such persons it is not unusual to demonstrate the presence of increased numbers of putrefactive anaërobes in the intestines. These persons, though in good health, are not really robust. A period of sustained hard work is followed by considerable mental and physical fatigue. Dining out and the use of alcoholic drinks are indulgences quickly followed by unpleasant consequences. Exercise out of doors becomes more and more of a necessity, and the individual becomes conscious of having to live within certain conditions compatible with the performance of his duties.

In my opinion the classification of intestinal toxemias advanced by Herter is the best, namely: (1) The indolic of chronic excessive intestinal putrefaction. This is marked by striking indicanuria and probably due to members of the *Bacillus coli* group. (2) The saccharobutyric type of chronic excessive intestinal putrefaction which seems to be initiated chiefly by the anaërobic forms. In its simplest examples there is very little indol in the gut. (3) A combined type, or cases resembling the characteristics of (1) and (2).

In the indolic type the members of the *Bacillus coli* form indol in considerable quantities and often they probably invade the small intestine in large numbers. The bacterial cleavages seem largely to replace normal tryptic digestion. These individuals are largely among those that are considered clinically as having intestinal toxemia. They are usually under-nourished, of low blood-pressure, usually with considerable neurologic symptoms, often ptosis of the abdominal organs, a marked fatigability, are constipated and have more or less dilatation and atony of the various abdominal organs. The examination of their stool will usually show that it is dark in color, hard, alkaline reaction; and a Gram differential stain will display an increased number of the *Bacillus coli* bacteria beyond the sixty-three per cent. which is normal. The examination of these stools in the fermentation tests displays the presence of ammonia, sulphureted hydrogen and methane gas, which total gas result is usually

abundant in the fermentation tubes. The urine usually shows an increased amount of indican and a high ethereal sulphate partition. Usually it is more concentrated than normal and often quite high in urates.

The saccharobutyric type is due to the activity of the strictly anaërobic butyric acid producing bacteria, of which the *Bacillus aërogenes capsulatus* and Gram-positive coccal forms are mostly responsible. To these, however, may be added the *Bacillus putrificus* and sometimes the bacillus of malignant edema. The abundance of putrefactive anaërobes, especially the *Bacillus aërogenes capsulatus*, gives a peculiar character to the intestinal contents. The organisms attack carbohydrates and proteins vigorously and butyric acid is formed from both, together at times with propionic, caproic or valeric acid. These acids give the peculiar odor to the stool. As a result the feces have a low specific gravity and often a decidedly light color. The Schmidt test with mercury bichloride usually gives a strong pink reaction. The stools have an acid reaction and are usually quite soft in character, with a result that these people are rarely constipated. Gram differential stain of these stools shows a marked increase in the Gram-positive organisms. These sometimes comprise the entire bacteriology that is met with. Stools which contain more than one-third of Gram-positive organisms are significant in the direction of this type of toxemia. On fermentation these stools surprisingly usually generate but small quantities of gas and this gas is usually of an acid character. The urines of these individuals rarely display anything that is significant, although not uncommonly uro-rosein is found in abundance. The same may be said of oxalic acid and uric acid, and the presence of various amounts of sugar is not uncommon.

The combined indolic and saccharobutyric type is a mixture of the above. It is the most difficult to diagnose from a laboratory standpoint because characteristics of one type, diametrically opposite from the other, usually combine with the other to present a more or less normal picture. In these instances it is only by very careful culturizing of the intestinal bacteria that it is possible to make a definite diagnosis, although usually the urine will display large quantities

of indol as well as uroscopine to give various indices of an intestinal toxemia.

RELATION OF BACTERIAL METABOLISM TO CERTAIN FOODS.

It is a well-known fact that perfectly wholesome foods may be prepared and sold in an apparently sound condition and yet contain within themselves the elements of their own destruction in the form of included bacteria, and also bacteria which would be inimical to the human being. It is a well-known fact that *Bacillus coli* grown in media containing only protein or protein derivatives will produce indol, phenol, hydrogen sulphide, ammonia and other products indicative of protein decomposition. It is apparent then that the organism of necessity utilizes the protein substances. Putrefaction is the result, because the medium becomes progressively alkaline, foul odors develop, and the resulting products are not only disagreeable to the senses, but are quite unfit for food. This is bacterial putrefaction. The same organism in the same protein medium, containing in addition sugar which the colon bacillus can utilize now, produces an entirely different kind of decomposition. In place of the products of putrefaction now appear lactic acid, small amounts of fatty acids, as well as carbon dioxide and hydrogen, which are characteristic of the breakdown of carbohydrate. The reaction now is permanently and progressively acid, the odor not offensive, and the products formed are innocuous and inoffensive. This is bacterial fermentation. It will thus be seen that in the presence of protein and sugar, most organisms utilize the sugar in preference to the proteins. This is because the carbohydrates are more easily metabolized than proteins, and because in the presence of protein they abstract only a small amount of nitrogen for their development. Whenever bacteria are presented simultaneously with protein and utilizable carbohydrate in the same medium, the structural needs are largely derived from the proteins, and the fuel requirements from the sugars. This fact of bacteria in sparing the proteins and using the carbohydrates is important in connection with the treatment of putrefactive conditions in the intestinal canal. The object of a diet rich

in carbohydrates is twofold: physiologically, to provide the patient with a readily assimilable food requiring the minimum amount of digestive energy to prepare it for the tissue needs, and bacteriologically, to shift bacterial metabolism from the destruction of body tissue for their food requirement to the utilization of carbohydrates for at least the major part of their dietary needs. This does not directly result in annihilation of the invading bacteria but it certainly approaches their metabolic reformation. The shifting of metabolism to sugar appears to deprive these organisms of one of their most potent weapons of defence and forces the parasite to act on the defensive, and theoretically at least, permitting the host to rally and strengthen his defensive and even his offensive powers earlier in the battle. While the above is true in the main, there are many cases of intestinal putrefaction in which no changing of the diet to the carbohydrate basis prevents the formation of putrefaction in the content of the intestinal canal. Whenever such is met with in spite of the diet, either a pathology is present which has been overlooked, additional or different bacterial methods of treatment are required, or the abnormal bacteriology is definitely facultative in the toxic way on any form of treatment.

SYMPTOMS OF CHRONIC EXCESSIVE INTESTINAL TOXEMIA.

It is a difficult task to describe the symptoms of intestinal toxemia. On the one hand they may be outlined about as broadly as is the field of medicine, on the other, they may be described in detail, both locally in the abdomen, and generally in the body. Then again, they may be considered entirely from the laboratory, and conditionally from the x-ray standpoint. Attempt will here be made to classify the clinical symptoms so that a semblance of order will be presented.

Fatigue. The victim of a long-standing intestinal toxemia presents certain characteristics. In the first place the matter of fatigue is conspicuous, and many of these individuals after engaging in moderate amounts of work and mental effort

become quite exhausted and perhaps must rest a while before they can recuperate their sense of well-being. This factor of fatigue is quite characteristic in all, and in women it is generally accompanied by more or less headaches, pains in the back and perhaps down the limbs, certain neuralgic manifestations together with circulatory ones, such as cold hands and feet, sweating of the palms, and various vasomotor factors. As a class, such individuals not only seem fatigued on exertion, but have a constantly running fatigue which brings them closely to more or less inherent devitality in the nervous system. Not uncommonly there may be a mental inability to continue with their efforts after three or four o'clock in the afternoon, and oftentimes such men will drink alcohol in the evening, or perhaps coffee, for the purpose of keeping their well-being until it is time to retire. It is not unusual for them over Sunday to acquire quite a reserve stock of vitality and to engage in work on Monday morning with vim and zest. Perhaps then the feelings of fatigue will not be manifest again until Tuesday afternoon or Wednesday, and toward the end of the week they are quite exhausted, perhaps even the mornings being interfered with so that they cannot conduct their business to their satisfaction. Dizziness is commonly present (indolic and mixed forms).

Anemia. Chronic anemia is a factor in a large number of cases; particularly is this true among the young and the women and those who are more or less housed during the winter time because of sedentary work. This anemia is never pronounced; it is of moderate grade and of the simple type. It is more pronounced where the sulphate partition of the urine is high and a condition of indicanuria exists. This is probably due to reduction of the red blood cells from resorbed sulphureted hydrogen gas from the intestine (indolic forms).

Anorexia. This is commonly present, such individuals rarely having a sharp appetite. They go along from day to day eating moderate amounts of food and very often they get along with very little food. Particularly is this the case where symptoms of distress on eating are present. In this instance they usually begin to ascribe the indigestion to vari-

ous foods that they eat and eliminate certain articles of diet, so that after a time they are eating less than is required to maintain a fair state of health. At other times their appetite may be good for two or three days, and perhaps longer, then suddenly it will drop off again into the chronic condition of loss of appetite and more or less anorexia (indolic and mixed forms).

Insomnia. Insomnia is quite a characteristic symptom of intestinal putrefaction. It is surprising to see how long many of these individuals continue taking various hypnotic and soporific drugs for the purpose of mastering a persistent insomnia the cause of which has not been corrected or even handled intelligently. Generally those individuals who have eaten three meals a day are considerably more toxic at the end of the day than in the morning, and it is not uncommon for them to lie awake in the early part of the night, getting to sleep when quite exhausted along toward the small hours of the morning, and in the morning they are generally quite sleepy and it is difficult for them to arise. The urine at the time of the insomnia generally contains a high sulphate partition, whereas in the morning it may be sulphate low. It is almost as if the toxic bodies absorbed from the intestinal canal stimulate the central nervous system so that normal sleep is not possible (indolic and mixed forms).

Skin. In addition to the characteristic skin which some of these individuals have, namely, a staining particularly manifest under the arms, in the groins, and around the neck, there may be certain forms of skin manifestations of a dermatological order. Eczema in children with intestinal toxemia, and also in adults, is most common. This eczema is generally of the eczema rubrum type. It may be that the eczema itself is not directly caused by the gastrointestinal condition, but it generally does aggravate the condition markedly so that the individual is more eczematous than would be the case if he did not have an intestinal toxemia. It is not uncommon when this has been cleared up, for an eczema which has been standing for years to entirely disappear, or practically become minimized to such an extent that the individual pays no further attention to it. Another common finding is the irritative rashes such as are repre-

sented in urticaria and erythemia. Recurring urticaria is particularly a symptom of the saccharobutyric form, but it may also exist in the mixed, or even the indolic forms. Angioneurotic edema may exist. Another cutaneous eruption caused by toxemia is acne. While acne may be caused by overeating or eating indigestible foods, indulging in alcohol, smoking, coffee, etc., there is no doubt that in many of the intractable forms the acne is due to the elimination of irritating substances from the intestinal canal in the skin. Lichen planus, which usually yields more readily to a vegetable diet, is due, in my opinion, to a chronic indicanuric or chronic putrefactive state of affairs in the intestinal canal rather more than to any other factor that is known (the three types).

Nervous System. There is absolutely no doubt about it that a distinct relationship exists between mental and nervous conditions and these disturbances of the intestinal tract. While certain nervous disorders may cause symptoms in the gastrointestinal canal, by far the largest majority of these functional disorders are brought about the other way. The most common of these is the so-called neurasthenia, or nervous exhaustion (complete neurosis). While it is true that certain conditions can bring on this disturbance in the nervous system, it is nevertheless true that the most common result of complication in intestinal toxemia is the so-called neurasthenia. The majority of these people have been treated from a neurological standpoint, sent away and so on, and many of them get over the major symptoms of the neurasthenia, but have a neurasthenic condition chronically present. This is due to the fact that the intestinal condition has not been corrected. In over 9000 cases of intestinal toxemia which I have treated, at least one-third have had sanitarium experiences for so-called neurasthenia. The nervous system is almost invariably affected in whole or in part by the toxemia. In every case of toxemia an examination of the gastrointestinal tract should be made, and also a search for the cause of the neurasthenia, because it is not normal for an individual of middle age to become neurasthenic without a cause. Of course, this cause may be something other than an intestinal condition but in the majority of instances it

cannot be, as is proved by the fact that these individuals do not become well until the intestinal condition has been corrected, and it is not uncommon for people who have been in more or less of a semineurasthenic state for years to become entirely well after the intestinal condition has been cleared away. In this same connection may be mentioned those who are sluggish of mentality, have a dullness and stupidity, a loss of concentration, loss of memory and in-coördination. In the psychic group are irritability, lack of confidence, excessive and useless worry, exaggerated introspection, hypochondriasis, photophobias, depression, melancholic state, impressions, illusions, etc. In a psychasthenic individual who has also an intestinal condition, the above mentioned symptoms are invariably intensified. Sensory polyneuritis of a mild grade and pronounced condition of irritative vagal disturbance (vagotonia) are commonly due to intestinal toxemia. What patients describe as "rheumatism," consisting of pain without any apparent manifestation in joints or muscles, is common among these people. The pains may be transitory, or last in the same location for days. They apparently are more myalgic or myositic in character, or due to nerve involvement in the muscle planes or perhaps in the sheaths or capsular ligaments about the joints.

Mental Diseases. Ross reports on the examination of urines the following statistics: In ninety-one apparently healthy individuals, 7.69 per cent. showed positive urines without the O-agent, and 21.37 per cent. positive with the O-agent. He claimed that among the insane the indolacetic acid test was most frequent, the results obtained being over forty-three per cent. positive compared to 21.37 per cent. positive in apparently healthy individuals.

Eye Symptoms. Among these individuals are found choroïditis, iritis, and various functional disturbances. The probabilities are that various types of color blindness and also various spots in the vitreous are largely due to intestinal conditions (indolic and mixed forms).

Asthma. In the absence of a hereditary history and when a renal and cardiac condition can be excluded, not a few cases of chronic essential asthma are due to intestinal toxemia. Some of the most striking results that I have achieved

TESTS OF URINES OF INSANE PATIENTS.

Type of Mental Disorder	No. of Cases	Test without O-agent		Test with O-agent	
		No. Positive	Per cent. Positive	No. Positive	Per cent. Positive
Organic brain disease (not differentiated)	7	1	14.29	2	28.58
General paralysis of the insane	21	2	9.52	4	19.04
Senile dementias	16	2	12.50	10	62.50
Infective exhaustive psychoses	3	1	33.30	3	100.00
Intoxication psychoses (alcohol and morphine)					
Chronic	14	1	7.14	4	28.57
Acute	6	1	16.67	2	33.33
Total	20	2	10.00	6	30.00
Dementia precox group					
Hebephrenic group	42	4	9.52	15	35.71
Katatonic	12	5	41.66	10	83.33
Paranoid	18	2	11.11	10	55.55
Not differentiated	102	8	7.84	48	47.06
Total	174	19	10.92	83	47.70
Manic depressive group					
Depressed	16	1	6.25	6	37.50
Excited	17	2	11.76	4	23.52
Remission	2	0		0	
Total	35	3	8.57	10	28.57
Involuntional melancholias	5	0		2	40.00
Psychoneuroses	2	0		2	100.00
Paranoic states	4	1	25.00	3	75.00
Psychopathic personalities	3	0		1	33.33
Epileptic psychoses	42	3	7.14	15	35.71
Defective mental development	26	3	11.54	15	57.70
Unclassified cases of insanity*	132	18	13.64	65	49.24
Tuberculosis in insane individuals† .	26	3	11.54	10	38.46
Very inactive insane individuals	25	4	16.00	13	52.00
Total insane individuals tested	490	55	11.22	211	43.05

have been in cases of chronic asthma, particularly those that occur in the late part of the winter, from the middle of January on, before the warmer weather sets in (saccharo-butyric and mixed forms).

Myocarditis. In middle life, in the absence of syphilis, alcohol or other toxic factors as the cause, and in the presence of a marked status of intestinal putrefaction, this disease

* Old cases which are largely cases of dementia precox undoubtedly.

† These individuals were also included in the different psychosis groups.

may be due to these intestinal states. As a rule, however, when the heart condition is distinct, although a general benefit in health may be brought about by the treatment of the intestinal condition, the heart condition does not clear up. The same may be said of vascular and renal conditions. There is no doubt that intestinal toxemia is a factor of much importance in connection with arteriosclerosis in middle age. When syphilis, lead, alcohol, and various other factors can be eliminated, a chronic intestinal condition must be taken into consideration as a possible cause. While with the improvement brought about in the intestinal condition, and perhaps even a complete cure, the stiffness in the vessels always continues, at the same time it does not seem to progress and many of the symptoms of increased pressure, when it exists, and others, are distinctly benefited by treatment of an intestinal state (saccharobutyric and mixed forms).

Joint Conditions. Arthritis deformans is, in my opinion, based upon the successful treatment of over seventy-five cases, largely due to an intestinal condition as the main cause. Some of the most striking successes I have had have been in cases of arthritis deformans. The relapses of the attacks have been stopped and distinct amelioration in the already affected joints has taken place. I do not agree with Pemberton in his conclusions that the successful treatment of arthritis deformans is a matter of diet and hygiene, and that the intestinal bacteriology is not an important factor. In my opinion, the most important factor in connection with the cause of this condition is an intestinal toxemia and the treatment in the individual case may not be a matter of diet so much, but may be of vaccine entirely (indolic and mixed forms).

Esophagus. Not a few of these individuals complain of substernal distress which on esophagoscopy shows that there is no pathology or congested condition of the esophageal mucous membrane. In my opinion various substernal distresses, probably esophageal in origin, are due to reversed peristalsis taking place through the cardia and stomach of individuals who have intestinal toxemia (all forms).

Hyperacidity and Hypersecretion. The textbooks on diseases of the stomach, for a long time have described these

conditions as entities without giving any causes beyond indiscretion in diet and drinking, and ulcer. The truth is that by far the largest number of cases of hyperacidity are due to chronic intestinal toxemia, generally of saccharobutyric type. It is not uncommon to find a hyperacidity existing at least for a while in the early stage of putrefaction in the intestine. But generally the picture in the putrefaction case is one of a lowered amount of secretion all the way to an achylia, which is due to an atrophic gastritis, the most common cause of an achylia we have (all forms).

Atony. Those states of loss of tone in the musculature of the stomach as well as diminution of peristaltic power, in my opinion, are due to an effect upon the Auerbach and Meissner plexuses by resorbed intestinal toxins. Such are not as manifest in the stomach as they are in the colon, because in intestinal toxemia any section of the gastro-intestinal canal can be relaxed due to a degeneration in the sympathetic plexuses (all forms).

Hyperesthesia Gastrica. By far the largest number of cases of hyperesthesia gastrica are due to indiscretions in diet, but not a few occur as a result of a long-standing intestinal toxemia, and these often are best treated by considering them as intestinal in origin (saccharobutyric and mixed forms).

Pyloritis. A condition hitherto not described in which the symptoms may be marked and which may simulate the presence of an ulcer or a carcinoma is an inflammatory disorder of the distal one-third of the stomach, generally a primary congestion which may even go on to an inflammation and more or less organization of tissues. These instances are due to a local infection, generally in achylic stomachs, but may also occur in intestinal toxemia, and they may be so bad as to require operation for stenosis and other reasons (all forms).

Ileal Stasis. By far the largest number of cases of putrefaction in the intestine have an ileal stasis. These represent just as definite a degree of stasis as when there is pathology in the region of the ileocecal valve. This stasis which seems manifest in the six-hour place by a roentgenographic examination may not be a stasis after all. It may be due to

an interference of the neuromuscular apparatus of the intestines due to a granular degeneration of the sympathetic plexuses, the sympathetic fibers and plexuses extraenteric in situation (indolic and mixed forms).

Appendix. It must be perfectly logical to anyone to consider that the large number of cases of acute and chronic disease of the appendix must have its origin in the bacteriology of the intestinal canal. My belief is that the main cause of chronic appendicitis is an intestinal toxemia, and this explains why it is that often after appendices are removed the symptoms continue just as before; because removal of the appendix does not cure intestinal toxemia. There is a feeling nowadays that in an instance of intestinal toxemia and diseased appendix, the removal of the appendix will have a beneficial effect upon the intestinal toxemia. This is true in only the minority of instances; the great majority of cases are the other way, namely, that the intestinal toxemia is primary and not removed by operation, and the removal of the appendix merely removes a resulting condition and not the actual cause (all forms).

Megacecum. This condition in the idiopathic type commonly is a resulting condition of intestinal toxemia. It is brought about, as mentioned before, by a resorption of toxic bodies from the interior of the gut and a gradual degeneration and shrinking of the cytoplasm of the cells in the Meissner and Auerbach plexuses in the right colon. Generally there is more or less of a catarrhal condition present at the same time—a so-called right sided colitis (all forms).

Chronic Colitis. Chronic colitis is often a resulting condition from an intestinal toxemia of long standing. Generally there is disease of the mucous membrane of the right side of the colon with perhaps more or less atrophic changes in the lower end of the colon and sigmoid as well. Generally there is more or less dilatation of the colon in these cases. Usually there is a distinct change in the mucous membrane to the extent of a hypertrophic inflammation or an atrophic destruction, dry in type. The hypertrophic type (generally due to a saccharobutyric toxemia) is usually accompanied by more or less spasm, which is commonly expressed as spastic constipation since constipation usually exists in these

cases. The atrophic form has generally a dilated gut with a dry mucous membrane.

Adhesions. It is not uncommon to find pericolonic adhesions in these cases. Adhesions may be found in the right colon or in the descending, perhaps only in the region of the brim of the pelvis on the left side. They are due to migration of bacteria through the mucous membrane and walls of the gut, and, gaining the peritoneal surface, causing a plastic and adhesive form of a low degree of peritonitis with adhesion formation, the original condition being intestinal toxemia (all forms).

Ptois. In about one-half of all the cases of ptosis a primary intestinal toxemia exists which, if not removed, usually causes the symptoms to reappear. Cases of ptosis plus toxemia must be divided into two groups: those with secondary and those with primary intestinal toxemia. In those that have a secondary intestinal toxemia, due to the ptosis, the treatment will be that for ptosis, after which the intestinal toxemia generally disappears. One-half of all cases of ptosis, however, have a primary intestinal toxemia. To benefit the ptosis and relieve the symptoms by the incorporation of all of the methods of treatment that are known for ptosis, benefits for a short time only, with a resumption of symptoms later. This is because the original primary toxemia has been left, eventually again causing symptoms in the abdomen.

Gall-bladder Condition. It is a well-known fact that in some individuals, particularly those who have intestinal toxemia, the bacteria may reach the general circulation, in which instance the liver may act as an organ of elimination, the bacteria gaining the bile and collecting in the gall-bladder and ducts may infect it with the production of cholecystitis, all the way from the strawberry type to that of the fibrous form, and when the gall-bladder is enough diseased, as in individuals who have a cholesteremia, there can occur a production of gall-stones. It may here be mentioned that intestinal toxemia is an active cause of cirrhosis of the liver. It is a well-known fact that many alcoholics do not get cirrhosis of the liver, and that others who drink do. It is also known that cirrhosis of the liver is not an uncommon

finding in the operating-room with people who have never drunk alcohol. In investigating this subject I have come to the conclusion that it is not the alcohol that causes cirrhosis of the liver, but the drinking of alcohol and malt fluids brings about a change in the bacteriology of the small intestine and this change is capable of producing cirrhosis of the liver, due to resorption of toxins (saccharobutyric form).

LABORATORY EXAMINATION.

All that pertains to the various tests of the urine, the significance of the sulphate bodies, oxalic acids, ammonia, bile pigment, tests for functional renal capacity, tests for function of the liver, examination of the feces in intestinal toxemia, the x-ray examination, need not be entered into here.

TREATMENT OF INTESTINAL TOXEMIA.

It is a well-known fact that the bacteriology of the human intestinal canal is quite facultative, and therefore in putrefactive conditions a carbohydrate and fat diet may be given which in the course of time turns the character from a putrefactive to a fermentative state of affairs; due to the encouragement that the change in diet brings about in the growth of such bacteria, perhaps of quite opposite groups. Then, too, organisms can actually change their metabolism and accommodate themselves to protein and then to a complete carbohydrate régime. These changes consist essentially of alteration between proteolytic and gas-forming bacteria on a protein diet and acid-forming bacteria on a carbohydrate régime. Often for a time, however, the absence of carbohydrate prevents the development of acid-forming bacteria on a protein diet, and the excessive amounts of acid by the fermentation of sugar prohibit the growth of the proteolytic aërogenic forms in the carbohydrate régime.

From these facts it is readily seen that the character of the foods taken in the alimentary canal will very profoundly alter the bacterial flora and the toxins of the canal. It might also be added that there are many cases in which, whatever the diet, whether protein or carbohydrate, the bacteriology continues in spite of the character of the food, and it should

also be remembered that bacteria may become facultative and may be quite as injurious in a fermentative sense as in a putrefactive.

Intestinal Antisepsis. For a good many years the medical profession has attempted by means of medication to accomplish an ideal which is not possible considering the many factors which are found present in the intestinal tract. The germicidal effect of drugs in the intestinal canal is an ostrich proposition. The substances used for this erroneous purpose have been many. Myriads of drugs and methods have been advanced, none of which have stood the test of time. It must be manifest that in a canal of intestines over twenty feet long, in which a number of phenomena take place, such an idealism as accomplishing intestinal antisepsis by any single method is entirely out of the question. A great array of drugs has been tested culturally, and reports pro and con have been expressed by the authors.

There is a great difference in the proportion of a disinfecting agent required to destroy microorganisms and that needed to restrain development. For example, the germicidal strength of creosote is about one to three hundred, but it is distinctly inimical to bacterial growth when present in the proportion of one part to four thousand. The following table gives the generally accepted strengths in which some of the intestinal antiseptics are positively efficient, and the dose this would represent for a volume of six thousand cubic centimeters:

	Antiseptic strength	Dose required
Beta-naphthol	1 to 10,000	9 grains
Copper sulphate	1 to 1,100	80 grains
Chlorine water (U. S. P.)	1 to 16	12 fluidounces
Creosote	1 to 3,000	30 minims
Phenol	1 to 700	3 drams
Salicylic acid	1 to 1,000	90 grains
Phenyl salicylate	1 to 800	115 grains*
Solution of formaldehyde (U. S. P.)	1 to 2,800	31 minims
Resorcinol	1 to 2,000	45 grains
Thymol	1 to 1,500	60 grains

* This figure is based on calculations from the amounts of phenol and salicylic acid in this compound. Bouchard found by actual experiment that it required 75 grains.

These figures are based on the supposition that all of the drug administered will remain as such in the intestinal tract, which of course is contrary to the fact.

In the experiments which Sucksdorff conducted, an effort was made to influence the number of bacteria in the alimentary canal by plating a weighed sample of the stool and counting the number of colonies in the usual manner of estimating bacteria and administering one of the following in the table that he gives:

WEIGHT OF BACTERIA.

Case	Without drug	With drug	Drug
1	7.44 grams	3.26 grams	Bismuth salicylate
2	5.0 grams	1.15 grams	Bismuth salicylate
3	2.74 grams	1.17 grams	Bismuth salicylate
4	2.23 grams	0.90 grams	Beta-naphthol
5	2.51 grams	1.44 grams	Beta-naphthol
6	1.69 grams	3.51 grams	Beta-naphthol

From the above, three substances turned out as being efficient in doses that are within the limits of safety. These are beta-naphthol, formaldehyde and creosote. It is probable, however, that formaldehyde is taken up with great rapidity, so that a practical intestinal antiseptic action would not be useful. Creosote, on the contrary, is absorbed with a fair degree of rapidity. It is possible by enteric coating to delay the absorption from the intestinal canal. Beta-naphthol is rather an insoluble substance, probably somewhat more soluble in the content of the bowel than in pure water. It is evident, however, that a substance which is so sparingly soluble as this, must go into solution in the intestines very slowly, and therefore linger in the bowel for a considerable length of time. For this reason, as well as for the fact that even in very dilute solution it exercises an antiseptic influence, it would seem to be the remedy of choice in cases in which we wish to influence bacteria in any part of the intestinal tract below the upper duodenum.

General Medicinal. Fatigue would have to be controlled by means of the well-known methods of rest, sufficient feeding, perhaps a sojourn in the country, tonics of various sorts,

and those which are metabolically constructive, as malt, the oils, hyperphosphates, etc., and the hematinic forms of tonic.

The anemia is controlled by means of hematinic tonics, of which the best forms are the inorganic forms of iron, hypodermically administered. Usually this is required but for a short time. A diet heavy in organic iron (such as meats), or a heavy iron-bearing vegetable diet and fruits, would answer the purpose in different instances.

Anorexia is controlled best by the use of elixir tinctura, ferri chloride and gentian well diluted before meals. Other forms of hematinic tonics might be in order for the purpose. Of course, the patient should be encouraged to eat sufficient amounts of food.

Insomnia, which is often a distressing factor in these conditions, had best not be controlled by hypnotic substances, excepting perhaps for a few days at the beginning of treatment. The insomnia usually disappears more or less as the intestinal condition improves. Of some value is the well known hot spinal douche before retiring, it usually taking about fifteen minutes until complete relaxation of the nervous system has taken place. Occasionally bromides are in order and perhaps a mixture of bromide and valerian through the day may encourage better sleeping at night. Various skin conditions would require the necessary lotions and ointments. States of neurasthenia require special attention, perhaps a rest in bed treatment, although those who are up and about and not distinctly exhausted would be benefited by the use of the various tonics hypodermically given, especially those containing glycerophosphites.

Hydrotherapeutic and mechanical measures, such as baths, electricity, massage, etc., may be employed. Such procedures are required to build up the general tone of the body, and where the means are not at hand, it may be necessary to send the individual to an institution equipped with apparatus for the purpose. In these instances there is often a complete mental diversion from business and family cares required; and those patients who have been depressed, upon becoming interested in golf, touring, music, reading, etc., which, bringing a more cheerful atmosphere, derive a beneficial effect from them. Very important, however, in their daily routine is

exercise. In the saccharobutyric cases the individuals are often quite obese, and exercise and dieting for the obesity would be in order. Such exercising should be of the heavy type so as to put as much strain on the muscular system as possible. In the indolic and mixed forms there is usually so much fatigue, devitality, etc., that strenuous exercising is contraindicated. In such instances, however, some exercise should be carried out and the system that I would recommend is a combination of massage and exercise at the same time, the various motions being as follows:

(1) Rub each foot on top with the other, at the same time rubbing the neck with the hand.

(2) Stroke each arm alternately, from the shoulder on the upper side down to finger tips, continuing underneath up again to armpit, then down same side of chest, and give a short stroke behind shoulder under armpit.

(3) Without bending the knees, bend the trunk forward and stroke from ankle up front part of legs, stomach and chest to the neck, at the same time raising the trunk; then stroke down chest to diaphragm; now bend trunk forward and grab around the back, with hands on each side of spine, as far as possible, and stroke from there down over lower back, continuing down back part of legs to heels.

(4) Stroke with both hands from each side of knee alternately, up over side of hip and loin, then straight across the abdomen with the one hand, and the diaphragm with the other.

(5) Press the arms and hands alternately with a swinging movement from behind down on something in front and on a level with the chest, at the same time giving the trunk a quarter turn to the side, and rubbing the kidneys and lower back with the back of the other hand. (If swinging and pressing with the right arm and hand, turn to the left and rub with the left hand, and *vice versa*.)

(6) This is similar to No. 5, but here swing the one arm sideways and press sideways on something in front of you, at the same time rubbing the left and right side alternately with the other hand. When rubbing the left side with the left hand from hip up over diaphragm, the trunk is turned

to the left, and the sideway swinging and pressing is done with the right arm and hand, and *vice versa*.

(7) Lift the knees alternately up to chest, then while legs go down stroke both sides of legs from ankle up over abdomen and chest to neck; then go down the spine with the back of one hand.

(8) Bend the trunk to right and left, at the same time stroke both sides from side of hip up to armpit with each hand alternately (heels together).

(9) Jerk the trunk to right and left, at the same time rubbing both hands across the chest.

(10) A rolling of the body at the hips, the hands making pressure on the abdomen on the relaxed side.

Practice a breathing exercise between each massage exercise except in No. 8, when legs remain stationary and feet are kept at least a foot apart and nearly parallel. Do not exercise for at least one hour after a meal. As a special breathing exercise: Inhale as deeply as possible with hands placed on loins, and elbows and shoulders thrown back, at the same time rising up on toes and bending the knees so that the heels touch the seat. Exhale the air through the mouth while rising up on legs and toes and down again on heels.

Intestinal Irrigation. Intestinal disinfection has been tried by means of the transintestinal lavage method, using various solutions for the purpose. What is accomplished here is a duodenal lavage and the benefits obtained are undoubtedly due to the washing of the intestinal content onward, and not to the various solutions which are used. Jutte uses a combination of saline cathartic with phenolphthalein. Other men claim benefit from the use of a solution of magnesium sulphate. There is no doubt that these methods accomplish a thorough cleansing of the lower end of the small intestine and all of the large, and it is my belief that such results as are accomplished have been brought about by the mechanical use of the water plus a purgative effect from the salts in solution, and not from any bactericidal action. In this sense they are worth the while, particularly in the saccharobutyric cases where there is a high anaërobic content, a large amount of Welch bacilli, and perhaps Gram-

positive diplococci or single coccacal growths. In my experience the use of the transintestinal lavage method of washing the small and large intestine is also worth while in those instances of saprophytic infection, both of the Gram-negative and Gram-positive types.

Colonic Irrigation. Numbers of men that I know of are engaged in irrigating the colon in instances of colitis, intestinal toxemia, etc., and I have yet to see the case (after an extensive study of this method) that has been benefited by it. There are not a few individuals who believe that they have been benefited, the effect being entirely one of purgation and mental suggestion, and not due to actual curative benefit brought about by the method. Of course, an emptying of the intestinal canal has been accomplished but this can be done quite as well by any patient using an enema and taking it lying on the left side or perhaps in the knee-chest position. No physician, nurse, high rectal tube, or any definite solution employed is worthy of consideration in these cases as a method of treating intestinal toxemia while under a physician's attention. It does not pay for the time and effort the medical man puts in on the effort, nor the patient for such as they have to pay for the treatment.

In my work I do not use any form of rectal irrigation, either accumulative or by recurrent tube. It is my belief that the human intestinal canal is not made for the purpose of withstanding large quantities of water. Many times distinct harm is done, and such results as may be brought about by a benefit in the pathology of the gut are so few that they are not worth the while, and could quite as well—in fact, much better—be accomplished by means of an anticonstipation diet, with perhaps the addition of slight purgative assistance which would insure the bowels moving normally.

The use of *vegetable purgatives*, particularly the drastic ones, should be entirely discouraged in cases of intestinal toxemia. It is my observation that they do more harm than good.

Intestinal Putrefaction and Water Drinking. Data is on hand which indicates a marked decrease in the output of bacteria in the feces when normal persons were caused to increase their water ingestion to thirty-four hundred and

fifty cubic centimeters per day, the water being taken with meals. That the use of water is worth while is evident, but in cases where there is ptosis or in which there are marked states of atony, the use of large amounts of water may be contraindicated. Water-drinking, however, cannot cure an intestinal toxemia, or even materially benefit it, if it is distinctive.

Dietetic Treatment. In the three types of toxemia, one must avoid continued reinfection that follows the ingestion of putrefactive bacteria with the food, promote prompt digestion and rapid absorption from the small intestine, and reduce the number of putrefactive anaërobes in the ileum and colon. To avoid the infection and reinfection, the mouth must receive scrupulous care. Carious teeth and gingivitis must be treated carefully by the intelligent use of toothbrush and of washes containing peroxide of hydrogen, camphophenique, or a weak solution of camphenol. Gastric lavage may be necessary in addition, perhaps best conducted in the morning. Oral sepsis requires strict attention.

The preparation of food and ordinary cleanliness is very effective; it is probably better to use cooked food as much as possible. Fruit is not above suspicion, for on the surface of most raw fruits bacteria swarm. The bacillus of malignant edema, for instance, being commonly present on the banana peel, and the *Bacillus putrificus* on grape skins. Pasteurization, or the ordinary boiling, kills the lactic acid formers in milk but does not harm the spores of the putrefactive organisms. Cheese contains many putrefactive forms and is best avoided, particularly important because many of these patients lack the protective action of a normal amount of hydrochloric acid in the stomach.

With rapid digestion and prompt absorption little pabulum for the putrefactive organisms reaches the colon. These processes are often facilitated by means of the secretory and motor functions of the stomach. Chief in importance here is proper mastication, which largely determines the ability of the body to utilize food. When large masses of meat are swallowed they commonly appear in the feces.

It is a good general rule to follow that putrefaction in the intestines is directly proportional to the amount of pro-

teins in the food. This is obtained from meats and from vegetables. The vegetables are comparatively safe, however, this being due to the fact that vegetable proteins are not so accessible either to the alimentary or bacterial enzymes, and therefore are not so readily decomposed, and also to the fact that bacteria utilize the carbohydrate substances in preference to protein. There is some difference in the effect of carbohydrate foods. Bread, sugar, potatoes, and legumes, often give rise to most of the organic acids and gases, whereas on the other hand, rice, sago, tapioca and arrowroot give rise to comparatively little fermentation.

So much has been written upon the subject of diet in connection with intestinal toxemia, and so little is worth while, that I beg to be excused for not quoting from the literature of the past, and will undertake to present only my own views. In a word, there is no definite method of dieting for intestinal toxemia, and it may also be added that there is no definitely indicated diet which would be helpful in all instances of the same type of condition. The best rule is to plan a diet according to the type of intestinal bacteriology that is present, the designation being according to whether the toxemia is putrefactive, fermentative, or of the mixed form, and then not to depend upon the diet alone or continuously. The rule I follow is to plan a normal diet, keeping the quantity of total protein down to not more than sixty to ninety grams in a day, roughing up the diet so as to overcome the element of constipation and the presence of a colitis if it exists, adding calories in the shape of fats when there is distinct debility or loss of tissue, the use of a high protein diet in saccharobutyric infections, and the employment of a diet which gives the minimum amount of food, allowing a general selection in cases of the mixed types. By following this plan I have been fairly successful in dieting instances of intestinal toxemia, not having the bother of making out an individual diet for each patient, or selecting various foods for this or that case. After making out individual lists along general lines for years I have come to the conclusion that I have largely hoodwinked myself. I now go upon the findings in the laboratory and x-ray examinations and make up a diet according to the type of

toxemia, the abdominal and general requirements of the individual, always encouraging the taking of sufficient amounts of food.

The type of diet I use in putrefactive cases where putrefaction is marked, is somewhat on the order of the following:

ALBUMINOUS DRINKS.

Egg broth	Kumyss
Eggnog	Zoolak
Junket eggnog	Rice milk
Albuminized water	Mutton broth
Albuminized clam water	Nutritious beef broth
Junket	Broth with grains
Grape juice	Egg broth
Grape juice and egg	Cocoa
Malted milk and egg	Malted milk cocoa

SOUPS.

With or Without Noodles, Crackers or Croutons.

Cream of celery soup	Mock bisque soup
Celery soup (gum gluten)	Green pea soup
Asparagus soup	Rice soup
Corn soup	Victoria soup (with broth)
Tomato soup (with broth)	

CEREALS.

Flour gruel	Rice, farina and oatmeal gruel
Porridge	Gum gluten breakfast food
Cracker gruel	Corn meal mush
Barley gruel	Hominy mush
Barley gruel with broth	Rolled oats
Arrowroot gruel	Steamed rice
Indian meal gruel	Boiled rice, farina, tapioca, sago

FRUITS.

Pineapple, Baked Banana, Steamed Rhubarb, Baked Apples and Apple Sauce, Stewed Prunes.

PASTRY.

Rolls, any kind; Bread, any kind; Cake or Crackers, any simple kinds.

SHELL FISH.

Raw oysters, with lemon only	Clam bouillon bisque
Pan roast oysters	Oyster stew and soup
Creamed oysters	Broiled oysters
Scalloped oysters	

EGGS (4 a day).

Soft boiled	Plain omelet
Steamed or baked	Foamy omelet
Golden rod eggs	Bread omelet
Egg nests	Poached eggs plain

FISH.

Creamed Fish, Baked or Boiled Fish (Plain Sauce).

VEGETABLES.

Boiled potatoes	Peas	} in purée form
Riced potatoes	Beans	
Mashed potatoes	Lentils	
Creamed potatoes	Spinach	
Baked potatoes		

DESSERTS.

Banana, peach, or apple custard	Junkets, custard, cocoa, coffee, plain
Soft custard	Gelatin
Meringue or floating island	Souffles
Chocolate	Cornstarch pudding
Malted milk or baked caramel	Cornstarch, fruit jelly
custard	Chocolate or cocoa blanc mange
Gum gluten pudding	Plain or tapioca cream
Rice pudding, peaches and rice	Pineapple cream
Steamed and boiled rice	Pineapple, apple or raspberry
Rice meringue	tapioca
Cream of rice pudding	Jellies (fruit and cereal)
Bread and cracker puddings	Fruit whips

In most instances, however, more or less use of protein is allowed, for many of these individuals require protein and can take it, providing it is in such form that it is readily digested and quickly absorbed so as not to accumulate in the colon. A copy of such diet, with constipation additions, together with the necessary increase in fats to encourage an increase in weight and strength, is the following:

GENERAL RULES.—Care should be taken that all of the foods are fresh, cleanly cooked and served, and that no foods that have been standing some hours in a cooked condition are partaken of. The mouth should be cleansed with plain water (preferably with a little bicarbonate of soda dissolved in it) before and after the meals and when possible at other times. A thorough cleansing of the teeth and a correction of such dental conditions as may exist and the use of dental floss is advisable. Adopt the plan of taking either four meals a day, moderate in amounts, or three meals a day with supplemental meals between them and before retiring. Thorough cooking, cutting foods finely on the plate or mashing them, complete mastication and slow eating are advised. Foods should not be eaten under conditions of fatigue, mental excitement or depression and a rest for an hour after each meal is desirable. No condiments such as sauces, mustard, pepper, lemon and so forth are allowed, and all foods should be plainly cooked and never in made up dishes. The use of salt is allowed. When there is distress in the stomach drink a glass of warm flaxseed water before meals, and no fluids, including soup, milk, water and so forth are allowed with the meals, although these may be taken in the meal intervals; drinking of a glass of cool water about an hour after the meal is sufficient.

Foods Allowed.—Bouillon, broth, consommés purées. Any of the well cooked cereals served with milk sugar and fresh cream. Eggs in any form but not more than two a day. Breads, rolls, zwieback, biscuits and crackers. All foods made of gelatin, not more than two ounces of meat, poultry, game and fish in a day. Take a half pint of fresh cream and as much unsalted butter and olive oil as possible each day. Any of the vegetables may be taken, except potatoes, tomatoes, asparagus and canned vegetables, but they must be cooked to softness; peas, beans, and lentils being the most wholesome. The green vegetables and salads are allowed. Other foods of value are: custards, egg and milk, peeled fruits, jellies, marmalades, apples, pears, green chicory and spinach. Eat at least three of the following bran gems, well buttered, during the course of the day.

Bran Gems.—One-half teaspoonful soda, saleratus, dissolved in $\frac{1}{2}$ cup hot water. Add, when dissolved, $\frac{3}{4}$ cup molasses, then a tablespoonful of butter, salt to taste, 2 cups wheat bran, 1 cup bran meal, 1 cup milk, mix all the above ingredients together. Put in a muffin pan and bake 45 minutes in a slow oven.

Two added measures of moving the bowels are to take a dish of stewed prunes sweetened with milk sugar instead of cane sugar, or from a teaspoonful to a tablespoonful of white vaselin before retiring. If then the bowels do not move, inject about a half a tumblerful of olive oil into the rectum at night.

It may be found that apple sauce, sweetened with milk sugar instead of cane sugar, may be more efficacious than the prunes. If such is the experience, apple sauce may be used instead or they may be taken alternately, eating one on one day, and the other the next.

Where distinct fermentation exists I use a high protein diet. A number of years ago the use of the beefsteak and water diet for the correction of intestinal toxemia had quite a vogue, and there is no doubt that considerable benefit was brought about by it. Such cases as improved were undoubtedly those of the saccharobutyric fermentation form and not the indolic or mixed forms, which manifestly would not be improved or even would be made worse by a diet high in proteins. A practical diet high in proteins is the following:

This diet is a temporary one. Take mostly meats—all forms of beef with the exception of cuts from the shoulder, kidneys and liver. The same is true of lamb. These meats should be fresh and taken in a broiled or roasted state. Mutton is permissible but no pork nor veal. May take any kind of fish broiled or boiled with the exception of shad roe and shell fish. May eat eggs in any form. Butter and whole milk are allowed, together with any form of simple cheese of the cream variety, such as Philadelphia, Neufchatel and cream cheese. Eat as much gelatin foods as possible. Oatmeal and rolled oats are allowed. May have breads or crackers made of gluten or rye flour. Lentils and dried peas are per-

missible. There is no objection to an occasional orange, pineapple or strawberries. The best drink would be chocolate and cocoa.

As was stated before, too much dependence should not be placed upon diet in the treatment of intestinal toxemia. Some benefit can be brought about, of course, but the cure of the condition on the basis of altering the bacteriology is quite temporary, idealistic, and not steadily useful. Some benefit can be brought about in this way, but it is only transitory because oftentimes when a definite absence, low or full protein diet is indicated, after a course of time it will be noted that the bacteriology present in the individual has become facultative and has now changed the type of the toxemia from one to another. Those cases always suggest that an infection is present in the gut contents and mucous membrane of the small and large intestine and perhaps no dieting will be of use, or again that a definite pathology is present and therefore no diet will avail, or that there may be some error in the secretions and the individual is toxic more from the mucous membrane than from the content of the gut or from an infection in the mucous membrane. However, the plan as mentioned above, the absence of protein diet, that in which the protein is low, and the one in which the protein is high, and these based upon the study of the case in the nature of the process in a biochemical way is the most advisable that I know of.

Vaccine Treatment. It is necessary here to consider whether the infection is simply of the intestinal content—namely, a true intestinal toxemia, or whether in addition to that there is an infection of the mucosa—namely, a distinct infection. When local pathology exists an infection of the mucosa is always present. It is probable in the toxemia due to infection of the content, wherein the mucous membrane and submucous tissues are in a resisting state, that very few if any general or constitutional symptoms are present. The treatment of these cases is essentially along general lines, together with proper dieting, the use of intestinal treatments, and so forth. But where distinct infection exists, the vaccine theory offers a means well worthy of employment. When infection of the tissues has taken place, distinct constitutional symptoms are also present. My belief is then that

whatever may be done in a simple way, unless vaccines are resorted to, but little if any benefit can be accomplished. Of course, the dietetic means of controlling the infection within the content of the gut are in order however much pathology there may be present.

For centuries it has been known that following an attack of certain acute infectious diseases there remains a certain loss of susceptibility to the contraction of a second attack of the same disease. Early in the eighteenth century this experience was utilized in vaccination against small-pox. This successful immunization can now be accomplished against cholera and typhoid fever, as well as conferring more or less benefit in other conditions.

Sir Almroth E. Wright, in his introductory address delivered before the Royal Society of Medicine on May 23, 1910, gave his conception of the rationale of vaccine therapy as the exploitation, in the interest of the infected tissue, of the unexercised immunizing capacities of the unaffected tissues. There exists a correlation between the vaccine and the antibacterial defenses of the body. This can easily be demonstrated by the opsonic index, which accurately measures the opsonic power of the blood, that is, the antibacterial defenses of the body.

It has been generally accepted that the immune bodies are produced almost wholly by the blood-making (hemapoietic) organs, and thence delivered into the blood stream. This theory fails to take into account the special immunity which certain tissues exhibit against infection, which in the intestines is definite.

The most obvious objection to the use of vaccines in general infections is that the patient is undergoing extreme intoxication and that the injection of vaccines will but add to this intoxication. This is not so in intestinal work. Another objection offered to the use of vaccines in general infections is that vaccines stimulate the production of bacteriolytic substances and that these substances may kill many bacteria and set free their toxins, thus overwhelming the body with toxic products. I have never seen reported harmful results relative to the sudden setting free of their toxins.

Christian Herter's work on the bacterial infections of the digestive tract appeared in 1907. Some time between that and 1910 Allen and others wrote on vaccine therapy. Recognizing the possibility of being able to favorably affect the intestinal infections in man by means of vaccine methods of treatment, I engaged in the clinical application of autogenous bacteria according to the infection I believed existed in intestinal toxemia, carefully noting the results. All of the first work done was by the use of autogenous colon vaccine, administered both subcutaneously and by way of the rectum. Chvostek had given colon vaccines by mouth, and when some very remarkable results by injection of autogenous colon bacillus vaccine had been accomplished by me (New York Medical Record, September 24, 1910), Turck suggested their use. In 1910 I had treated one hundred and twenty-seven cases of distinct intestinal toxemia by means of autogenous colon vaccine, with a number of striking results, some indifferent results, and a few failures. I suggested that it might be possible to influence the cases better by use of autogenous colon vaccine administered by rectum and using the viable form, employing much larger doses than possible by subcutaneous injection, the initial dose of which is limited to between twenty-five million and fifty million organisms, given every fourth day, and gradually increased. The colon route was also deemed advisable because of some very severe reactions, local and general, in the subcutaneous injection method. It was observed by me that as many as from five trillion to thirty trillion viable colon bacteria could be given by rectum without much reaction, and that a leucocytosis was possible of accomplishment in the same way. Also that the resulting leucocytosis was more steady than that by subcutaneous injection, and if the vaccine could be kept up for three or four months the results were quite as good—in fact, were better than by the cutaneous route. Since that time, Satterlee has reported good results by the use of colon bacillus vaccine given subcutaneously.

The original use of the colon vaccine by me was suggested by the conclusions drawn by Herter, that the colon bacillus was capable of initiating the toxic process in the intestine,

although it usually did not finish the putrefaction, this being accomplished by other forms of anaërobic growths. It is a well-known fact that many strains of the *Bacillus coli* are beneficial in the intestinal canal and inhibit putrefaction and fermentation rather than initiate or encourage it. The whole question is bound up in the strains of the coli, and it has been my experience that there are essentially four pathogenic types in the seventeen different strains. It is a well known fact, for instance, that the colon bacilli recovered from the human intestinal canal is the most virulent of any.

Having concluded that the *Bacillus coli* have to do with the production of symptoms in the case, and decided upon a subcutaneous administration, the process of treatment is simple. The patient is given a dose of castor oil, and the third or fourth stool following is taken to make the vaccine from. As many colonies and strains as possible should be used to make the vaccine, which would be a polyvalent autogenous emulsion and perhaps the infecting strain given.

Depending upon the age and clinical conclusion as to the vitality of the individual in the subcutaneous method the initial dose is from about fifteen million to twenty-five million of dead bacteria. The dose is repeated every four to seven days, and a gradual increase of about twenty million bacteria each time until the maximum of two hundred million or three hundred million bacteria is reached. One does not see much, if any, improvement until several doses have been given, and in fact it may be necessary to go on for two or three months before any results are accomplished. There should be a reaction after each dose, which consists of local redness and swelling, with perhaps a considerable spreading until a large area is involved.

Because of the failure in many instances of the use of autogenous coli vaccine subcutaneously administered, I believed that the rectal route would be more worth a trial, and so far as I know, I was the first one to use the subcutaneous and the rectal routes for influencing conditions of intestinal toxemia by the administration of coli vaccine. I desire to quote from the article published on the rectal instillation method, which holds almost as true today as it did in 1910, and after about twenty-two hundred cases have been treated:

"My interest in the use of a direct bacterial method of treatment was suggested by the uniformity of the different bacterial pictures seen in examining specimens of normal and abnormal stools stained by the Gram differential method; the fact that the coli bacilli grow only for a certain time in bouillon, when, probably because of their generation of thermostabile and thermolabile substances allied to phenol, their proliferation is inhibited and they become quiescent or resting but not killed (the latter was a confirmation of Conradi and Krupjurveit observations with the *Bacillus coli communis* and the *Bacillus lactis aërogenes*, the last of which organisms probably suggested the use of the Bulgarian form as a germicidal bacteria against all others), and also, the fact that colon bacillus was most numerous in stools of normal individuals, but was diminished or absent in some cases of excessive chronic intestinal putrefaction, having excess of indican in the urine, even when the intestinal contents have somewhat rapidly passed through the colon.

"I have come to the following conclusions: In cases of chronic intestinal putrefaction wherein carcinoma, colonic obstruction, abnormal organic disease of the pancreas or stomach, or gastrointestinal atrophy, etc., are not responsible for the condition, much benefit can come from raising the content of *Bacillus coli communis* in the gut by instillation either of the autogenous mixed forms or strains from other individuals; whether this is due to a real antagonism between the toxins of the *Bacillus coli* and the other putrefactive organisms, these toxins being existant in the cultures injected (which bacteriologists claim is slight in amount with the *Bacillus coli*), or whether the *Bacillus coli* so injected are directly toxic to those other bacteria, I am not prepared to say. (We know that the dead as well as the living *Bacillus coli* are very toxic.) But it is certainly true that an individual who has high Gram-positive stools can, by the autogenous mixed or *Bacillus coli* instillations, quickly have the running proportion between the Gram-negatives and Gram-positives raised to a proportion equivalent to normal, this being due to a raising in the *Bacillus coli* and also to a diminution in the putrefactive Gram-positives as the first become more numerous. With this more equal proportion

between the two types of organisms, the conjugate sulphate of the urine diminishes and the cases make substantial improvement in the general body. Whether this raising of the Gram-negatives is only due to the *Bacillus coli* or only to the *Bacillus lactosus aërogenes* (both being antitoxic to other bacteria), or to both together, is not always possible of determination, since both are much alike in their morphology and are Gram-negative in character. But the cultural methods of distinguishing these forms from each other and the results obtained when only the *Bacillus coli* were used in the injections incline me to believe that these disorders are due to a shortage or inactivity of the *Bacillus coli*, and that the latter are the most powerful agents in the human alimentary canal against the development of putrefactive conditions, and, that while outside of the intestine they are destructive and pyogenic, inside of the canal they commonly are welcome hosts. As regards the permanency of the benefit brought about, it is apparent that about half of the cases which do not respond to simple treatments clear up inside of from one to three months on this treatment, but that the other half may not remain substantially benefited even when the instillations are kept up for longer periods. These latter show relapses when the instillations have been stopped for a week or more, quickly responding again when the injections are reestablished and some eventually clear up. It is probable that in the relapsing cases some permanent anatomical mischief preventing the establishment of a normal bacterial intestinal condition is present, which is either the cause of the development of the condition in the first instance and then its prolongation, or that there is present some anatomical or permanent functional change affecting normal secretions and motility of the digestive canal in asthenic ways. Cases of putrefactive conditions when in doubt may first be treated by the routine methods of treatment (diet, hygiene, tonics, etc.) before instituting the instillations. Then if no benefit is noted on the *Bacillus coli* alone the *Bacillus lactosus aërogenes* may also be added to them, the two grown together in the single media, and these tried for a length of time. And if after these, no sustained or apparent benefit is achieved, the other vaccines or antagonisms

should be tried, and should it then be that no benefit is accomplished, we have present some anatomic and permanent complication affecting the function of the gut, and the best we can hope for is a resort to surgery in some of the cases, or a longer interval continuation of instillations of whatever form of culture has shown the best results in the particular case."

After numberless attempts to administer rectally the innocent forms of coli vaccine, I have come to the conclusion that not only do they act in a beneficial way by inhibiting the processes of fermentation and putrefaction by such effect as they exert upon the bacteria present in the intestinal canal, but they produce a leucocytosis or a stimulation of leucocytes in the walls of the intestine with the generation of more or less of an antibody formation which acts as a means to elevate resistance against bacteria in a general way. I cannot explain the results accomplished along any other line than that there must be this leucocytic antitoxic body formation, because the individuals remain permanently well and are singularly free from infections of all kinds for some years. It may be, after all, that the results accomplished by my method are distinctly along the vaccine immunity line, and not along the line of increasing the number of colon bacilli in the intestinal canal, or any local effect of that sort.

The choice between the two methods—namely, subcutaneous of dead bacteria which have been killed by heat (and if required, by means of any phenol substance), or the viable autogenous rectally instilled—is a matter according to the individual case. After a length of time, one instinctively can draw distinctions as to which is the wiser method to pursue, whether by vaccination, on the one hand, or for antagonistic effect, on the other. This is somewhat of an art that comes only from experience and cannot be described in words. There are some instances where it is wise to use both methods at the same time, but this is not a good practice because it is not possible to state which one of the methods brought about the beneficial results. It is better to use one, then the other, or, better yet, to decide when possible on which is the best one to use according to the

individual case. In a general way, infections of the intestinal content are best controlled by means of the rectal administration, while those of the true toxemia wherein there is invasion and infection of the mucosa or tissues of the body, by the subcutaneous. Many cases have both an infection of the content and infection of the tissues and therefore may require both methods of attack eventually.

The method of taking innocent forms of bacteria by mouth, the subcutaneous immunity vaccine method, and the rectal instillation of *Bacillus coli* has failed me at times. This is sometimes due to fault in the selection of the cases and at other times due to improper vaccine employed—occasionally to improper laboratory procedure in estimating the pathogenic forms present in the individual. Ofttimes it is necessary to reexamine the case, go over the stools carefully again, particularly from a bacteriological standpoint, and do a restudy of the sedimentary culture fields. It is not uncommon that a conclusion which was drawn in the first instance, was distinctly different from the conclusion that is drawn in the second or third examination. The colon bacilli are great complicators of the work, and not uncommonly an underlying or overlying bacteriology is of very much more importance in the production of the symptoms than the simple presence of the organism. In these instances no results, or only very mild ones, would be brought about by the use of the coli vaccine, and as my work multiplied, the number of cases in which other vaccines were more desirable constantly increased until now over two thousand cases have been treated with other than *Bacillus coli*.

It is not advisable to give a long dissertation on the *pros* and *cons* on the elaborated vaccine side of the subject, particularly in the matter of ideally selecting the bacteria for the case. This can only be accomplished by careful laboratory work. The following, then, in toto, is the plan of the work I now follow when I employ the vaccine immunity methods of giving the infecting organisms, and the two methods of administration of the vaccine. A single bacterium is always employed in the vaccine used.

BASSLER'S BACTERIAL TREATMENTS IN PRIMARY TOXEMIAS.

*Rectal and Subcutaneous Routes.**Vaccine Immunity Methods.*

SACCHARO-BUTYRIC	B. <i>aërogenes</i> capsulatus	(rectal) (skin; rarely)
	Gram-positive diplococci	(rectal; rarely)
	Gram-positive single cocci	(rectal)
	B. <i>bifidus</i>	(rectal; rarely)
	B. <i>putrificus</i>	(rectal; rarely)
INDOLIC	B. <i>coli</i> communis	(rectal) Identification of which of the 17 varieties, and that one used. (skin)
	B. <i>mysentericus</i>	(rectal)
	B. <i>liquefaciens</i>	(rectal)
	B. <i>proteus</i>	
	Gram-negative streptococci	(skin)
MIXED	Staphylococci	(skin)
	Combinations of above according to predomination of fermentation or putrefaction, and types of organism. The rectal method is used here altogether, and effort is made to get reactions and a leucocytosis of from 10 to 20 thousand within eight hours after the injections.	

After all that has been said in connection with the diet, general care and vaccines, there still can be found instances where there is no result worth while, either such as can be proven in the laboratory or results which the individual shows in a state of improved health. In these instances it has been my custom, after an extensive study of bacterial antagonisms, to use the following method of administering bacteria, all the work then being done either by rectal administration or administration through the duodenal tube, usually the first. After seven years' experience in the study of bacterial antagonisms to meet such cases as fail to respond to the vaccine immunity plan, the following represents the plan I now follow. It must be remembered here, however, that the results may not be as substantial as those accomplished by means of the vaccine immunity method:

Not a few of the cases have been treated along a line which I have designated as biochemical alteration. In these instances the infecting bacterium is employed differently from the vaccine method, in which the organism employed is gained in as pure culture as possible in the shortest time after the stool specimen is on hand. By the biochemic altera-

BASSLER'S BACTERIAL TREATMENTS IN PRIMARY TOXEMIAS.

*Rectal and Subcutaneous Routes.**Bacterial Antagonism Methods.*

SACCHARO-BUTYRIC (Heavy protein diet.)	B. <i>aërogenes</i> capsulatus	} B. coli (many different strains and perhaps collected from different sources). For the first two the <i>a</i> , for the second two the <i>b</i> , strains are best.
	Gram-positive diplococci	
	Gram-positive single cocci	
	B. <i>bifidus</i>	
INDOLIC (Low protein and high carbohydrate and hydrocarbon diet.)	B. coli	} B. <i>acidophilus</i> B. <i>bulgarius</i> B. <i>lactis aërogenes</i> G. P. <i>diplococci</i> G. P. <i>cocci</i>
	B. <i>mysentericus</i>	
	Gram-negative streptococci	
	Gram-negative staphylococci	
	B. <i>proteus vulgaris</i> (B. Welch)	
	B. <i>cloaca</i> (B. coli, polyvalent strains)	
	B. <i>pyocyaneus</i> (B. coli, <i>a</i> strains)	
	B. <i>putrificus</i> (B. coli, <i>b</i> strains)	

MIXED

(Least possible amounts of food, no cheese, peelings of fruits, mostly boiled foods.) No action on antagonisms possible by rectal or subcutaneous methods excepting when a predominant type of bacteria is present.

The difference between the *a* and *b* strains of B. coli is that the *a* does not produce gas in saccharose; the *b* does. The effects are the same on all the other sugars and on the coagulation of milk.

tion method, the vaccine used is that in which the organism has been grown in successive subcultures, these averaging about five. According to the organism, the medium is changed, sometimes at each inoculation, the idea being to change it both morphologically and in chemical ways. This often robs it of its specificity and toxicity, and at the same time it may answer for vaccine effect on the organism infecting the host. It is only possible by the study of the individual case and then perhaps after more or less instillation experience to decide whether the biochemic alteration would be the best to employ either all the way through the bacterial treatment in total time or in a part of it. The list of this method is the following:

BASSLER'S BACTERIAL TREATMENTS IN PRIMARY TOXEMIAS.

*Rectal Route.**Biochemical Alterations.*

Occasionally infecting bacteria can be changed biochemically by growing under different media and these used in the effort to substitute those present in the body. Successful examples of this have been found in cases of infections with the *B. coli*, *aërogenes capsulatus*, *mysentericus*, and *putrificus*.

Surgical Treatment of Intestinal Toxemia (Stasis). Watching a number of baneful results that have been brought about by surgeons who have followed the propaganda of Lane and others, I am pleased that I have not worshipped at the altar of the surgical treatment of intestinal toxemia for the purpose of changing the biology of the intestinal canal. I am satisfied that the surgical therapy of drainage (which would have to do with pus, urine, etc.), or the removal of diseased tissue, are surgical fundamentals that should be continued. But, these conditions of toxemia are a biologic state and one cannot change the biology of the intestinal canal in satisfactory ways by changing the fecal current. Deaver was perfectly right about that. To remove an appendix, or to relieve a kink which is causing a distinct obstruction, may in individual instances be a justifiable surgical procedure. There are a few cases of reconstruction of the right side of the colon in which it was indicated. But the removal of the colon, or to do an anastomosis where there is not a distinct intestinal obstruction is improper surgical procedure and it is only necessary to follow a number of these cases which have been operated upon by enthusiastic surgeons to prove this. It is unfortunate that the biology of this subject is not as well understood by surgeons as it should be, but it is plain to me that of late they are not engaging in as much exploitation in this field as several years ago, evidently because they did not accomplish results which were substantial, or none at all, or because the rate of mortality from excision was too high. It is not uncommon to see patients improve for a while after such surgical procedures, but usually in the course of six months or a year, almost always by the latter period, they are quite as bad as they were before; simply because their intestinal toxemia still exists. And it is not uncommon, even when the entire colon has been removed,

to see a condition of affairs which is worse than the state of the individual before the operation was performed. The more experience I have, the fewer the operations of questionable sorts are advised, and when the case is simply one of an intestinal toxemia, however much pathology there may be in the right half of the colon, it is never promptly considered surgical, but always treated medically for a while. In a word, for the treatment of intestinal toxemia in all stages, surgical procedure is not indicated; if a definite obstruction exists, yes, but for the ordinary case, no. There may be a resulting pathology in the appendix, gall-bladder, etc., that requires surgery, but for the toxemia or such stasis that is not due to definite obstruction, never.

CHRONIC INTERSTITIAL HEPATITIS. (CIRRHOSIS OF THE LIVER.)

The so-called cirrhosis of the liver has been much and variously classified, but the term was first employed by Laennec to describe the yellowish "hobnails," which he regarded as new-growth. There are two types of chronic diffuse disorder of the liver, attended by fibrosis, to which the term cirrhosis may be limited. The first is a common disorder, usually due to the misuse of alcohol, and is characterized by a moderate enlargement of the liver which in late stages may be reduced in size, by phenomena of portal obstruction, by the absence of jaundice, and after the development of symptoms it usually runs a comparatively short course. The second of these is more rare and is characterized by marked and persistent enlargement of the liver and spleen, by chronic jaundice, periodic attacks of abdominal pain and fever, by the absence of manifestations of portal obstruction mainly ascites, and runs a comparatively long course. This latter is classified as biliary, Hanot's, or hypertrophic cirrhosis.

As a rule the so-called alcoholic cirrhosis cases are those of the Laennec type, although Hanot's cirrhosis sometimes occurs. The terms atrophic and hypertrophic cirrhosis of the liver should be discarded. The reason of this is because

in the hypertrophic liver atrophic areas are found and in the atrophic liver hypertrophic areas are usually present.

Perhaps the best classifications of these two cirrhoses of the liver are portal and biliary; portal (Laennec's) because the etiological factor is perhaps always transmitted by the portal circulation and the obstructive symptoms are those of portal obstruction; and biliary (Hanot's) because the essential lesion is a radicular cholangitis, and the conspicuous clinical feature is jaundice, due to obstruction to the free flow of bile.

PORTAL CIRRHOSIS.

This is a chronic degenerative and inflammatory disease of the liver characterized by recurring degeneration and regeneration of the hepatic parenchyma and associated with connective tissue fibrosis in and about the interlobular and portal spaces, all of which leads to obstruction of the portal circulation.

Etiology. Portal cirrhosis is peculiarly a disease of middle life. It is most common during the fifth decade, although it may be met with in early adult life and not uncommonly in late. A notable number of cases have occurred in young children. It is more common in men than in women.

Portal cirrhosis is undoubtedly the expression of the activity of some poison or poisons which, reaching the liver by way of the portal vein, brings about the process. In its production alcohol seems to be especially active however it is taken. How the alcohol acts is not definitely known. For a long time it was believed that alcohol was a direct irritant or poison to the liver cells, in that way bringing about the condition. In my observations this cannot be so because one commonly has no clinical significance of there being present a portal cirrhosis in those who have drunk immoderately of alcohol for years, and not uncommonly at operation definite cirrhosis of the liver is met with in people who have never tasted alcohol. I am willing to agree that alcohol is a potent factor in the production of the condition, but to me its influence is only indirect. The toxic substances which produce the condition are generated in the small intestine, and while alcohol encourages the production of these

toxins in certain individuals, it is only so when a definite type of bacteriology in the small intestine is present. What has already been described in chronic intestinal toxemia as the saccharobutyric type of toxemia, in my opinion, comprises the main etiological factors of portal cirrhosis. It is in this type of toxemia that alcohol or the drinking of spirituous or malt fluids is especially harmful and the immediate result is the intensification. This is probably brought about by resorption of the fatty acids (lactic, butyric, acetic, valerianic, etc.) which are so abundantly produced in the intestinal condition mentioned.

It has also been stated that infections of various kinds may be followed by cirrhosis, but the relationship of the one to the other is not clinically distinct.

Pathology. The liver varies much in size in different cases, and in the same case at different times. As a rule the liver is of increased density (increased specific gravity), so that a small liver may weigh more than a liver of normal size. It is of increased consistency and lessened elasticity. The capsule is often opaque, sometimes considerably thickened. The surface of the liver is distinctly granular, with grayish-white opaque depressions alternating with pale, yellowish-brown, sometimes reddish-brown, roundish or ovoid elevations—the so-called granular or “hobnail” liver. On section the liver cuts with increased resistance, being much denser, firmer and tougher than normally. The blood-vessels of the liver show more or less well-marked changes. The gall-bladder and biliary ducts are usually normal. On microscopical examination of cross section, fibrosis with destruction of the liver cells and arrangement of normal liver parenchyma is plainly evident. Evidences of hyperplasia of the liver cells are readily found in almost every cirrhotic liver, even in far-advanced cases. There is usually a great increase in the bile ducts in the liver, although this is probably more relative than actual. The spleen is enlarged in at least eighty per cent. of the cases. The gastrointestinal tract usually shows a congestion and thickening of the mucosa of the esophagus with varices in the lower end. The stomach is commonly the seat of chronic gastritis, often associated with small superficial ulcers or abrasions, pig-

mentary infiltration, and dilated veins. The intestines usually show the lesions of chronic passive congestion and chronic enteritis with pigmentation. The kidneys show deviations from the normal in about half of the cases. The heart is often fibroid and fatty, and consequently dilated.

Symptoms. The diagnosis of cirrhosis of the liver should be made early when it may be difficult to do, rather than late when it is an easy matter. Much could be done for these cases if the diagnosis were made earlier than the profession makes it today. The reason an early diagnosis is not made is because the condition may remain latent for many years. Even well advanced lesions of the liver take place without the onset of symptoms. Symptomatically the disease may be divided into the preascitic and ascitic stages, and the symptoms into those which are due to obstruction and those due to toxicity.

In the early stages of cirrhosis of the liver the symptoms are not well defined because of the active hyperemia of the liver, the patient complains of ill-defined or vague gastric symptoms, a sense of weight in the right side of the upper abdomen with perhaps short transitory attacks of slight fever. There may be some pain in the region of the liver which on examination may be enlarged and tender. Such attacks may last several days, disappear, and recur at longer or shorter intervals. Usually there is also present a gastro-intestinal catarrh. The patient complains of coated tongue, irregular appetite, flatulence, epigastric distress, especially after eating, sometimes of nausea and vomiting, irregular action of the bowels, hemorrhoids, etc. As a rule the functional capacity of the stomach and intestines is limited, and when these conditions are present with an impairment of general health, the history of alcoholism or taking of moderate amounts of alcohol in a chronic way, the presence of a chronic intestinal toxemia of the saccharobutyric type, cirrhosis of the liver should be looked for whether hematemesis or ascites are present or not.

Hematemesis is an initial symptom in some cases, and it is a common event some time in the course of most cases. It not uncommonly occurs early while the liver is large but it may occur late in the disease, that is, after the develop-

ment of ascites and when the liver may have become small. It happens as an initial symptom in perhaps a third of all cases and in my experience is more times the cause for hematemesis in consultation practice than is ulcer of the stomach itself. The vomiting of blood may come on without warning, in which instance it is usually from the esophagus. The hemorrhage, as a rule, is large and consists usually of dark, partially clotted blood. A second or third hemorrhage in the early stages of the case is not infrequent and may lead directly to death. Repeated hemorrhages may occur for years. With the hematemesis there is usually blood in the stools, but blood may occur in the stools without the vomiting of blood, especially when the bleeding into the stomach is slow, and also when, as is not uncommon, the source of the blood is the stomach or intestine. In suspected cases of cirrhosis examination of the stools for blood should be resorted to early. Hemorrhage from or into other parts of the body is very common. The tendency of cirrhotic subjects to bleed independently of stasis and the presence of jaundice is well known, and is attributed to toxemia with disturbed nutrition, the result of functional insufficiency of the liver. Among such hemorrhages seen are epistaxis and bleeding from the gums. Frequently the blood is carried to the fauces or pharynx, and, being then spat out, may simulate hemoptysis. Bleeding from the lungs is not uncommon. Menorrhagia and metrorrhagia occur particularly in the early stages. Hemorrhages, usually petechial, into or beneath the skin, the mucous membranes, and the serous membranes, are not rare, although not as common as in biliary cirrhosis.

Jaundice is not a part of portal cirrhosis, but it occurs as a complication, some time during the course, of from ten to twenty per cent. of the cases. A faint subicteric hue to the conjunctiva and the skin is not uncommon. It may come and go repeatedly and is usually due to a radicular cholangitis. In the terminal stages more or less marked jaundice may result from associated catarrh of the biliary ducts, duodenal catarrh, or degenerative changes in the liver cells and the associated changes of acute yellow atrophy.

Toxic symptoms may develop at any time during the course of the disease. They are much less common early

than late. The minor symptoms are those of restlessness, weakness, headache, and itching. This itching may be unassociated with jaundice. The more severe toxic symptoms are apathy, stupor, coma, an active noisy delirium, convulsions, paralysis, contracture, although not a few cases of portal cirrhosis are seen without these.

Cirrhosis of the liver may be afebrile throughout its course, during the terminal stage the temperature may be subnormal but attacks of fever, 100° to 102.5° F., are not uncommon. The more continuous fever, which is rather common late in the disease, is usually due to tuberculosis of the lungs, peritoneum, etc.

Physical Signs. The general aspect of these subjects is usually quite characteristic and often suggests the diagnosis at a glance. In the early stages there is a pallor and sallowness, the face being of a muddy hue or subicteroid. Later on, the patient becomes thin and emaciated, the musculature is soft and flabby, the general integument is harsh, dry and wrinkled, the face is drawn, often bloated, the eyes are sunken, the cheeks and temples hollow, the lips are dry and fissured, the tongue is spongy, the breath is foul, the skin of the face and cheeks reveals many distended venules that are prone to bleed. The abdomen is more or less markedly (sometimes enormously) distended, and is in notable contrast to the emaciated face and extremities. The umbilicus becomes everted and the abdominal wall reveals enlarged and varicose veins due to the establishment of a collateral circulation.

Examination of the liver shows it to be enlarged in most cases, but the size varies considerably in different cases and in the same case at different times. Often during the prevalence of the ascites, the lower border of the liver may be palpated one, two or three inches breadth below the margin of the ribs in the right nipple line. It is a good clinical rule to follow that when the edge of the liver can be felt the liver is pathologic. The organ is often tender, the surface irregular, and in some emaciated subjects the hobnail surface can be readily appreciated by the palpating hand. In any event, whether small or large, the organ can often (but not always) be palpated by firm pressure upward under

the ribs. The left lobe is usually not as much enlarged as the right and this is quite a significant factor in differentiating cirrhosis of the liver from new growths affecting the stomach and the liver, such as a carcinoma, in which event usually the left lobe is the one which is enlarged rather than the right.

The spleen is usually palpable two or three fingers' breadth below the left costal margin. In the early stages the spleen is sometimes not notably increased in consistency but later on it is usually firm and often tender.

Ascites is often the first obtrusive manifestation that leads the patient to seek medical advice. As a rule its onset is gradual and without definite cause, and the accumulation is slow. Sometimes the fluid accumulates with marked rapidity, in which event it is attributable to thrombosis of the portal vein. Ascites is to be looked upon as a late event, although it is not improbable that in the early stages of the disease a small amount of fluid into the peritoneum occurs comparatively early. As a rule there is no direct relationship between the size of the liver and the onset or the degree of ascites. The ascitic fluid varies in amount, in the average case from four to eight or ten liters, but it may be as much as twenty liters, with the consequent enormous distention. The fluid is usually pale amber in color, clear, somewhat opalescent, and alkaline. It has a specific gravity of 1.008 to 1.015, and it contains 0.5 to 1 per cent. of albumin, and occasionally also traces of urea, urobilin, purin bodies, sugar, etc. Sometimes it is turbid from associated peritonitis. As a rule it is sterile unless there has been some secondary infection. Cytological studies show the cellular constituents to be few and to consist of lymphocytes and endothelial cells, with a few erythrocytes and leucocytes.

Varying with the amount of fluid there is more or less displacement and compression of the abdominal and thoracic organs. The liver and the diaphragm are pushed up and cause embarrassment of the respiration and the heart action, and not infrequently compression and consequent congestion and collapse and perhaps bronchopneumonia, of the bases of the lungs, particularly the right.

Edema is common late in the disease, that is, it comes on after the ascites. It is most marked in the feet and legs, but may involve the trunk, especially the dependent portions; rarely anasarca ensues. The edema of the lower extremities is referable to interference with the venous flow in the inferior vena cava. Occasionally edema precedes the development of the ascites, in which event it may be due to one of several factors.

The action of the heart is often impeded by the upward pressure exerted by the ascites. The blood-pressure is usually low, the pulse small and frequently rapid, and the breathing labored. The myocardium is often weak, due to fibroid alterations the consequence of alcoholism, malnutrition and the toxemia or cachexia. A systolic murmur and other evidences of dilatation may develop.

The blood shows the changes of secondary anemia. There is no leucocytosis unless there is some associated infection, which is not rare. The urine is usually diminished in amount, in consequence of deficient absorption of fluid; the specific gravity and color are high due to concentration; sometimes the urine is reddish in color and is highly acid, the reddish color being due to urobilin and urates; often it contains albumin due to congestion due to failing heart, parenchymatous changes, nephritis, etc.

The cirrhotic subject is peculiarly susceptible to infections of diverse sorts, both acute and chronic. Tuberculosis is the most common, being more common in adults than in children, and shows a special predilection for the lungs and the peritoneum. The complication is often overlooked, because unthought of and unsought. However, it should always be suspected when there is fever otherwise unaccounted for. Tuberculous pleuritis is not rare, but non-tuberculous pleuritis also occurs. The pleuritis is usually right-sided, but it may be left-sided, or bilateral. Evidences of involvement of the kidneys occur in about one-half of the cases. Peripheral alcoholic neuritis, neuromuscular pains and tenderness, muscular cramps, cutaneous hyperesthesia, lost knee-jerks, etc., occur in considerable proportion of cases, and are often overlooked or the symptoms are misinterpreted. A number of acute infections, especially pyococcic infections (local and

general), endocarditis, croupous pneumonia, etc., are not uncommon and may determine the fatal issue.

Diagnosis. The diagnosis of cirrhosis of the liver in the early stages is not always an easy matter but it should be made more frequently than it is. In alcoholic subjects with dyspepsia and enlarged and tender liver, an enlarged spleen, perhaps recurring attacks of pain in the region of the liver, with slight fever or slight jaundice, and urobilinuria, the possibility of this condition should be kept in mind. Later, when hematemesis, ascites, the hepatic facies, etc., have developed, the diagnosis can no longer be in doubt. All the cases of saccharobutyric and chronic intestinal toxemia occurring in the fourth, fifth or sixth decade of life should be examined to see if this clinical condition is present.

When the liver is enlarged and there is no ascites, one must exclude other causes of enlargement of the liver, such as passive congestion due to various causes, fatty liver, amyloid disease, leukemia, malaria, and syphilis.

The occurrence of hematemesis and other gastrointestinal hemorrhages necessitates differentiation from gastric and duodenal ulcer. Hematemesis, especially if small in amount, may suggest carcinoma of the stomach. Splenic anemia, or Banti's disease, may be excluded by the absence of recurring hemorrhages with intervals of comparative health, of primary enlargement of the spleen, of early anemia, and of later development of signs of portal obstruction, and the comparative youth of the subjects—twentieth to the fortieth years.

When ascites has developed one must exclude other causes of ascites, especially chronic peritonitis and perihepatitis (multiple serositis), thrombosis of the portal vein, tumors of the peritoneum and the abdominal organs, chronic cardiac disease, and cachectic states. A not uncommon cause of ascites in the female is disease of the uterus or adnexa which causes a pelvic thrombosis with ascites and papillomatous cysts of the ovaries, especially when they have spread into the peritoneum. In the ascites of tumors of the peritoneum or the abdominal viscera, the seat of the primary growth may be more or less obvious, metastases may be found in the supraclavicular fossa, in glands, about the umbilicus, also along the course of the falciform ligament of the liver, etc.

The ascites of chronic cardiac disease should be recognized by detecting the disorder of the heart or an antecedent pulmonary disorder with consecutive hypertrophy and dilatation of the heart. The edema of heart disease begins usually in the legs and other dependent portions of the body.

The ascites of cachectic states, such as advanced nephritis, amyloid disease, leukemia, various anemic conditions, convalescence from typhoid and other infections, is usually slight in grade, often only part of general anasarca, and is associated with readily recognizable disorders; only when there is associated cardiac or hepatic disease does the ascites become well marked.

Occasionally examination of the fluid removed by tapping or otherwise aids in the diagnosis. The transudate of cachectic states is clear, pale amber colored, and limpid; it has a specific gravity of 1.010 or less, and contains less than one per cent. of albumin; its cellular content is slight and consists of a few lymphocytes and endothelial cells, and perhaps an occasional erythrocyte. The transudate due to mechanical obstruction is usually higher in specific gravity, and contains from one to three per cent. of albumin; its cellular content consists of a few lymphocytes and endothelial cells, and an occasional polynuclear leucocyte. The inflammatory exudates may be serous, serofibrinous, purulent, or hemorrhagic in character; even the serous exudates are usually slightly turbid; they have a specific gravity of 1.015 or more, and they contain from three to six per cent. or more of albumin; their cellular content is high in proportion and there are usually lymphocytes in large numbers (upward of ninety per cent.) seen best in tuberculous infection of the peritoneum.

Prognosis. On the whole, the outlook in portal cirrhosis is not encouraging, which fact is due largely to the nature of the disease and the advance it has made when usually recognized. There is much evidence accrued, however, that if the disease is recognized at an early stage it could often be brought to a standstill and perhaps cured. The occurrence of hematemesis does not make the outlook hopeless, since it is sometimes an early symptom and may lead the patient to mend his ways, in consequence of which he may have no additional symptoms, perhaps for years. With the onset

of ascites the prognosis becomes distinctly bad, since ascites must be looked upon as a terminal event in the ordinary course of the disease. The prognosis is also bad in the event of anasarca, emaciation, cholemia, failure of the heart or kidneys, and any of the many complications and secondary infections. Ordinarily the disease runs a fatal course within three years from the onset of symptoms, although sometimes a patient may live a number of years—eight or ten. Usually the course is rapid, six or eight months, especially in young subjects when addicted to alcohol.

Treatment. The treatment of portal cirrhosis, to be effective, must be instituted during the formative stage of the disorder. Little beneficial effect can be expected after the destruction of much hepatic parenchyma and the overgrowth of much fibrous tissue. The use of alcohol must be interdicted, stimulating and highly seasoned foods, foods likely to undergo fermentation in the intestinal tract, etc.—all should be strictly prohibited. As a rule, when the disease is well advanced interdiction of alcohol or a controlling diet do not make for improvement. In these cases the alcohol should be reduced to the smallest amount consistent with general well-being and this amount should be given well diluted with the meals. *Nux vomica* or strychnin is often an excellent substitute for the alcohol and is otherwise beneficial. In some cases after its use for a time the alcohol may be entirely withdrawn without ill effects to the patient.

Undoubtedly the best form of diet to employ is milk. It is sufficiently nourishing, readily digested and assimilated, its proteid is easier utilized by the liver than that of meat, it leaves little residue, it usually does not lead to intestinal fermentation and autotoxemia, and it is somewhat diuretic. In all severe cases it should be the only diet for a time, at least—four to six weeks, depending upon the improvement shown by the patient. Two or three quarts should be taken during the twenty-four hours. Some alkali or alkaline water may be added to the milk to advantage or the milk may be flavored with various substances such as vanilla, tea, coffee, chocolate, cocoa, etc. If the milk should seem to disagree with the patient, kumyss and various forms of fermented milk are allowed. At the end of from four to six weeks in

ordinary cases, if improvement has occurred, the diet may be increased by the addition of eggs, gruels, cereals, and stewed fruits, and from time to time some fish or green vegetables may be permitted. After the lapse of a month or two, depending upon the condition of the patient, the absolute milk diet should be again resorted to for several weeks; thus alternating, the diet should be continued indefinitely. In general, meat, all highly seasoned and stimulating foods, spices, tea, and coffee, etc., should be prohibited, because of their irritating effect upon an already damaged liver; the use of carbohydrate foods and of fats also should be carefully supervised, because the carbohydrates particularly are inimical to results in instances of the saccharobutyric toxemia.

Where a saccharobutyric toxemia exists the institution of a high protein diet, following the milk cure, this being done to control the fermentation process and production of large amounts of organic acids in the intestines, is often of much value. If the diagnosis can be made before ascites has taken place, even though hematemesis has occurred and this type of intestinal toxemia is present, the additional diet may be a high protein one, consisting mainly of meat, fish, fowl, eggs, etc. In such cases the implantation of large amounts of viable *Bacillus coli* into the colon often answers to good purpose. For the control of the catarrhal condition present in the stomach, gastric lavages are sometimes of value, but lavaging by the transintestinal method with a hypertonic solution is often quite magical in relieving the dyspeptic symptoms present and causing a reduction of the size of the liver and spleen.

Comparatively little can be done to influence directly the lesions in the liver, but it is always well to try the effect of potassium iodide in the hope that it may do good. Minute doses of mercuric bichloride, perhaps combined with the iodide, or ammonium chloride, or nitrohydrochloric acid, also seem to do good in some cases. The use of organic preparations of liver has proved of no value whatever.

Aside from the foregoing, special attention must be paid to the gastrointestinal tract, and individual treatment of such symptoms as indigestion, nausea, vomiting, constipation,

diarrhea, etc., should be instituted when these occur. In the early stages much benefit may follow a course of treatment at some one of the well known spas, because the purgative waters of the spas have a good influence in lessening the intestinal catarrh and the portal congestion, and by the free evacuations that they induce, ridding the system of noxious autotoxins. The good effect of free catharsis should be an important part of the treatment throughout the course of the disease.

The occurrence of hematemesis calls for treatment similar to that of bleeding in gastric ulcer. The patient should remain in bed absolutely at rest, and tranquillity should be promoted by a hypodermic injection of morphin, an ice-bag may be applied to the epigastrium, all food and drink should be withheld; to relieve the dryness and thirst the mouth and lips should be moistened, or small bits of ice may be given to the patient to suck, but the water should not be swallowed. Adrenalin chloride (thirty minims of the one to one thousand solution in one dram of water) may be given by the mouth, in the hope that it may reach and influence locally the bleeding point. In some cases gallic acid, turpentine, aromatic sulphuric acid, etc., given by mouth, seem to be of service. If there is much shock and collapse, stimulants and hypodermoclysis should be resorted to. For several days after the hemorrhage no food should be given by mouth. The subsequent feeding and after-treatment is analogous to that of gastric ulcer.

The onset of severe nervous symptoms (cholemia, acidosis) calls for treatment required in uremia—free purgation, sweating (by means of hot packs, hot baths, the cautious use of pilocarpin hypodermically, etc.), and diuresis (by means of hot applications to the loins, large amounts of water to drink, alkaline diuretics, digitalis, etc.), and hypodermoclysis.

The ascites may sometimes be favorably influenced by the use of the purgatives already mentioned, and diuretics, such as the alkaline diuretics, caffein, spartein, theobromin, etc. In the majority of cases, however, medicinal measures are of little if any value in ascites, especially if the amount of fluid be large; resort, therefore, must be had to tapping. Tapping may be said to be indicated when the fluid causes

local discomfort, dyspnea, pulmonary congestion or atelectasis, oliguria, etc. There is no advantage in delaying tapping when it once has been indicated; indeed, the resort to tapping as often as it may be indicated may lead to the development of adhesions which may augment the already formed collateral circulation. When done under aseptic precautions, the danger of infection may be disregarded; when the fluid is withdrawn slowly there is little likelihood of collapse on the part of the patient. The tapping may be done with a trocar and cannula in the median line midway between the umbilicus and the pubes (after preliminary catheterization of the bladder), or preferably in the linea alba.

Operative relief of the ascites and of the conditions upon which it depends is sometimes undertaken. After close study of not a few of these cases extending over twenty-five years of time and running through quite a period of enthusiasm on operative procedure for these individuals, I have now come to the conclusion that no operative procedure of any kind that has yet been devised is of much avail. I have seen one or two instances where apparently distinct good was done, but following these cases long enough I have observed that the length of life, even though the symptoms be somewhat ameliorated, has not been prolonged.

BILIARY CIRRHOSIS.

Biliary cirrhosis is a chronic disorder of the liver, probably infectious in origin, characterized anatomically by radicular cholangitis and consecutive hyperplasia, and clinically by chronic jaundice and enlargement of the liver and spleen. The disorder is commonly spoken of as Hanot's cirrhosis in contradistinction to Laennec's, or portal cirrhosis.

This disorder is especially common during adolescence and early adult life. Most cases occur between the twentieth and the thirtieth year. It seems to be rare after the fortieth year, although it is quite common in children, especially in India.

Etiology. The exact nature of the disease is not known. A few of the subjects have been alcoholic, but on the whole

it seems that alcohol plays at most a minor etiological rôle. There is some inconclusive or indefinite evidence that the disorder may be the consequence of some infection that produces a radicular cholangitis. That it is infectious is suggested by the common occurrence of attacks of fever and leucocytosis and the not rare occurrence of general glandular enlargement. Organisms have been isolated from the blood, liver and spleen during life in several cases. It is probable that the infection occurs by way of the general circulation rather than an ascending infection up the liver ducts.

Pathology. The liver is enlarged, and although its shape is maintained, its consistency is increased and its elasticity diminished. On the surface of the liver there are exhibited many fine granulations in marked contrast to the coarse granulations of portal cirrhosis. The liver is usually dark olive-green in color. Microscopically the obtrusive feature consists of an overgrowth of fibrous connective tissue, but the basic and essential process seems to be the radicular cholangitis—which is disclosed by proliferation and desquamation of the epithelium of the small biliary ducts. These lead to obstruction of the lumina of the small ducts, with dilatation of the biliary canaliculi. Branching columns of cells, so-called pseudobiliary canaliculi, in and about the periphery of the liver lobules, constitute a conspicuous feature of the lesions. The liver cells, themselves, may exhibit comparatively inconsequential changes. The conditions of the liver under these circumstances are somewhat analogous to those of Banti's disease, although, of course, jaundice is not a feature of Banti's disease.

As a rule all the organs of the body are bile-stained. The spleen is enlarged, and in children it may be as large or larger than the liver. Microscopically it reveals lymphoid and endothelial hyperplasia and fibrosis with consecutive atrophy of the parenchyma.

Symptoms. The onset of the disease is insidious. For some time there may be ill-defined symptoms of poor health, general malaise, weakness, loss of flesh, etc., as well as some dyspepsia, coated tongue, poor appetite, perhaps nausea, diarrhea, etc. In the great majority of cases the first obtrusive symptom is jaundice, which is slight at first, not more than

a lemon tint to the skin or the conjunctiva. The usual concomitants of protracted jaundice are seen, such as intense itching, eczema, lichen, sometimes xanthelasma, etc.; bleeding from the nose or the gums or other mucous membranes may occur from time to time for a long period. The urine may show the presence of bile pigment. The feces also contains bile pigments and may be very dark in contrast to the clay-colored stools of obstructive jaundice.

In addition to the jaundice, the disease is characterized by periodic attacks of more or less severe abdominal pain, especially in the region of the liver, sometimes attended by nausea and vomiting and associated with fever, leucocytosis, and increase of the jaundice. These attacks occur varyingly, the temperature usually not going above 102° F.

The *examination* usually reveals a bulging of the lower right costal arch and the upper part of the abdomen, which is found to be due to a uniformly enlarged liver. It presents a smooth surface with a distinct firm feeling to the organ, its edge being sharp and well defined. Usually the enlargement is progressive. The spleen is markedly enlarged, much more so than in portal cirrhosis. It is hard and presents a well-defined edge.

The *diagnosis* presents no unusual difficulties. The important diagnostic features consist of the occurrence in a young, usually non-alcoholic subject, of chronic progressive jaundice, with considerable and persistent enlargement of the liver and spleen, and periodic attacks of abdominal pain, fever, and leucocytosis, with subsequent increase in the jaundice, and no signs of cholelithiasis or portal obstruction. As a rule there are no hemorrhagic symptoms. Diarrhea is common. The disease usually runs a period of from five to ten years or more.

Prognosis. The outlook as to cure is hopeless. The periods of remission of the symptoms are often of long duration and the general health may be well maintained. The prognosis is especially bad in the event of severe jaundice with nervous symptoms (fever, delirium, coma, etc.), marked general weakness, intercurrent complications, etc. When hemorrhages do occur the prognosis is especially sad.

Treatment. The treatment is largely symptomatic and in a way corresponds to that for portal cirrhosis. The best hygienic conditions possible should be maintained, these comprising much fresh air, non-exposure to cold and damp, moderate and carefully regulated exercise. The diet may be more generous than in portal cirrhosis but care should be taken not to provoke gastrointestinal derangements. In two recent cases that I have seen, much benefit seems to have been brought about by the continued use of urotropin and the intravenous administration of urotone.

Diseases of the Liver, Gall-Bladder, and Pancreas

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Diseases of the Liver, Gall- Bladder, and Pancreas.

FOREWORD.

THAT portion of the abdomen immediately surrounding the intersection of the transpyloric line and an extension of the parasternal line onto the abdomen, including adjoining portions of the right hypochondriac, epigastric and umbilical regions may be termed the storm center of disease conditions in the digestive tract. Here, in the majority of instances, is the focus of acute abdominal conditions and of the so-called "acute abdomen." In this region lie the pyloric end of the stomach, the duodenum, the pancreas, the liver and gall-bladder, all organs more or less directly concerned with the digestive function and closely associated with the production of symptom complexes. In addition the epigastrium is the seat of reflex symptoms from the lower intestinal tract and pelvis. As Bassler aptly calls it the "mirror of the abdomen." However, typical acute cases of such conditions as gall-stone colic, cholecystitis, perforation, pancreatitis, and acute gastric conditions, are usually easily recognized and it will not be necessary to discuss them here.

Chronic conditions, on the other hand, are not so easily recognized. Most of them begin insidiously and are often secondary to chronic disease of other parts of the body, most frequently the lower intestinal tract. Under these circumstances the pathological changes proceed so slowly in these organs, that the patient is not aware of them or neglects the warnings until serious functional disturbance occurs, or he attributes the symptoms to the primary disease. Thus it is that chronic inflammatory, cirrhotic, and atrophic processes may go on for years before either patient or physician suspects them. These organs also often become extensively involved in sclerotic, hypertrophic, atrophic, and other degenerative changes, as a part of general disease conditions

such as arteriosclerosis, diabetes mellitus, senility, cachexia of malignancy, nephritis, gout, tuberculosis, pregnancy, focal infections, toxemias, and asthenia, or due to the toxic effects of acute communicable diseases as scarlet fever, measles, pneumonia, diphtheria, influenza, and also those of chronic chemical poisoning. Chronic constipation, colitis, toxemia, chronic diarrhea, and similar and associated conditions, usually produce the same changes in these organs, particularly the liver and pancreas, by the constant absorption of toxic food and bacterial products carried by the portal stream and lymphatics.

Unfortunately physical examination gives us comparatively little information concerning these organs until the process is quite well advanced. Until the advent of the duodenal tube we knew little concerning the physiological and pathological states of these organs in the human body. Now much interest is being shown in the examination of the duodenal contents, secretions of the liver and pancreas, and considerable progress is being made. Several liver function tests have been devised, principal among which are the phenoltetrachlorophthalein, galactose, or levulose tolerance test, and examination of the urine for urobilinogen and urea content. However, none of these are entirely satisfactory, as they do not consistently show the extent of liver tissue involved even when carried out quantitatively. There is also considerable chance for error. Most of the quantitative tests are difficult and time consuming, and a single test does not prove that the four functions attributed to the liver are or are not being carried on efficiently, inasmuch as one or more of these may be deranged and yet the secretory power be apparently normal. Much valuable information may be obtained concerning the pancreas by the examination of pancreatic juice, which can be analyzed quantitatively without much difficulty, for the activity of the three enzymes per unit of secretion. This estimation is easily carried out by the methods suggested by Einhorn and others.

Clinically it is difficult to recognize and differentiate early functional disturbances of these organs. Certain symptoms are recognized and suspected of being due to an inefficient liver or pancreas but they do not make up distinct entities

or syndromes. Indefinite conditions often diagnosed as "torpid liver," with malaise, laziness, constipation, etc.; chronic irregular dyspepsias, the etiology of which cannot be determined; sub-icteric states, etc., suggest liver insufficiency. Symptoms suggesting early pancreatic insufficiency are even more indefinite and obscure. They may be referred to the stomach as belching, sensation of fullness in the epigastrium, or less often a slight feeling of pain or discomfort just to the left of the umbilicus after meals.

Prophylaxis is the keynote of modern medicine. Probably no part of the body receives as much abuse and neglect as the gastrointestinal tract, the results of which are ultimately seen in the conditions discussed above. In this field also may strikingly be seen the benefits of correct hygienic living, proper eating habits and diet, and the results of correction of improper or faulty habits. On this account and the fact that early symptomatology is absent or obscure and diagnosis is difficult, we cannot too strongly emphasize the importance of careful history taking, including especially details of habits of eating, diet, rest, exercise, constipation, alcoholism, excessive coffee and tea drinking, and all other hygienic factors which may have a bearing on the production of these states. When such faults are recognized during adolescence or the "habit forming years," much may be accomplished to prevent the occurrence in later life of the conditions enumerated, and even many cases of cholecystitis, gall-stones, cirrhosis, etc., by the correction of such faults and habits.

DISEASES OF THE LIVER AND GALL-BLADDER.

• JAUNDICE.

Jaundice is not a disease entity but a symptom of many affections of the biliary tract and is characterized by coloration (by bile pigment) of the skin, mucous membranes, and other body tissues and fluids. The jaundice may be of three types, depending on the etiology; known as obstructive, toxic or hemolytic, and hereditary.

Obstructive jaundice is caused by conditions producing partial or complete obstruction of the common duct, hepatic duct,

or biliary radicles. The obstruction may be caused by foreign bodies within the ducts, such as gall-stones, pancreatic calculi, and parasites; by inflammation of the duodenum and lining membrane of the ducts; by stricture or obliteration of the ducts; by tumors growing within the duct or closing its orifice; and by pressure from without from tumors of the liver, pancreas, stomach, duodenum, and omentum, and from contraction of adhesions or bands causing constrictions, kinks, etc. In this type of jaundice, following the obstruction, the liver cells continue to secrete bile which collects in and dilates the ducts and radicles until they become greatly distended and the pressure increases. The dilatation extends even to the biliary capillaries from which the bile gains access to the lymphatic system, through which it is carried to the general circulation. There are several general symptoms commonly associated with jaundice.

The icterus or tinting of the skin and conjunctiva varies greatly in its intensity. The depth of color usually increases with the severity and chronicity of the disease, but may be very intense in many of the acute cases. In the milder types, such as catarrhal jaundice, it may be lemon yellow or a deep yellow if the onset is sudden. In the more chronic cases and particularly the permanent type due to cancer of the liver, biliary passages and head of the pancreas, the color is very dark, olive-green or black-green. When due to cancer it often has a peculiar dull appearance when cachexia is present. The sclera and conjunctiva are usually the first tissues to show evidence of coloration. All the tissues of the body except the nervous system are involved in the process.

The secretions are colored with bile pigment and the sweat usually contains enough to stain the patient's linen. Inflammatory exudates and transudates are stained, but the tears, saliva, and milk rarely contain a noticeable amount unless they contain inflammatory products. A large amount of the pigment is excreted by the kidneys. The color of the urine varies from a light yellow to very dark brown, green or green-black. The urine foams easily and the bubbles are colored yellow. Several tests have been devised to detect bile, the simplest and most commonly used being Gmelin's nitric acid test. The presence of bile pigment in the urine

may be detected before coloration of the sclera or conjunctiva is observed. In cases of long standing, albumin and tube casts are commonly found, probably due to a toxic nephritis.

The stools are pale and clay-colored from the absence of bile. The fat is increased in amount and to this is attributed their pasty and fetid character. Constipation is most common, although there may be diarrhea due to decomposition.

The pulse is usually very slow in the early stages, especially in catarrhal jaundice and acute cases with sudden onset. It may be as low as twenty per minute, and the respirations usually correspond to the pulse rate and may be reduced to ten or even seven per minute. Xanthopsia or yellow vision and other disturbances of vision may occur.

General pruritis is a frequent accompaniment of jaundice and may be very distressing. Various forms of skin eruptions may occur, such as boils, urticaria, acne, and lichen. Sweating is common and may be confined to the palms of the hand or the abdomen.

There is also a marked tendency to hemorrhage. The coagulation time may be greatly increased so that bleeding is hard to control. In protracted cases there may be hemorrhages from the mucous membranes, subcutaneous extravasations, and purpura.

Serious disturbances of the central nervous system occur in many cases of jaundice. There may be manifestations of depression, melancholia, weakness, asthenia, vertigo, headache, and insomnia; or they may be irritative in nature causing severe headache, delirium, coma, and convulsions. Usually the patient has a rapid pulse, slight fever, dry tongue, and passes into the so-called "typhoid state." This condition was thought to be due to the presence of bile acids in the blood-stream and was termed cholemia, but it probably is due to inefficiency of the detoxifying function of the liver.

Toxemic or hemolytic jaundice is also fundamentally obstructive in nature. There is first an increase in the destruction of erythrocytes by hemolysis liberating hemoglobin with increased formation and excretion of bile pigments known as polychromia. The bile becomes more viscid and with precipitation of albuminous material becomes inspissated, causing obstruction in the capillaries and smaller bile ducts. This

is followed by reabsorption of bile, and jaundice. Later the viscosity decreases, the flow is reestablished and the jaundice disappears.

Toxemic jaundice may be caused by specific poisons, such as toluylendiamin, phosphorus, arsenic, and snake venom. It may be associated with specific fevers, such as yellow fever, malaria, pyemia, relapsing fever, typhus, enteric fever, scarlatina, etc., or with infectious conditions of a more obscure nature and designated as epidemic, infectious, febrile, malignant jaundice, icterus gravis, Weil's disease, and acute yellow atrophy.

The icterus usually is not as intense as in the obstructive form and may be only a slight lemon tint. It is further differentiated from the obstructive type by the presence of bile in the stools and the absence of bile pigment in the urine. The urinary pigments, however, are increased. The constitutional symptoms may be very severe, with high fever, delirium, convulsions, suppression of urine, black vomit, and subcutaneous hemorrhages.

The hereditary type affects principally the new-born and disappears after a few days or weeks in those cases which recover.

CONGESTION OF THE LIVER.

Owing to the fact that the liver is a large organ with a large blood supply from two sources, namely, the portal vein and hepatic artery, it is subject to rapid changes in its blood content both physiologically and pathologically. The normal volume of blood in the liver varies widely and increases with the increased flow in the portal system during digestion and functional activity, and it also acts in common with the other abdominal viscera in equalizing blood distribution during vasomotor changes. Hyperemia or congestion depends on an increased inflow from the portal vein or hepatic artery, or a decreased outflow, due to obstruction of the vena cava or hepatic vein. Thus two types of congestion may be distinguished, active and passive, which are in practically all cases dependent on factors outside of the liver itself, being respectively of a toxic and gastrointestinal origin or largely mechanical of cardiac origin.

Active Congestion.

This is usually due to an increased flow through the hepatic artery and portal vein, principally the latter. After each meal the rapid absorption by the portal vessels induces a transient hyperemia of the organ which, however, is entirely physiological. In individuals who habitually eat too much, are obese, and are of sedentary habits, this hyperemia becomes increased beyond the physiological limits and tends to be excessive and more chronic until ultimately functional disturbances result. Overeating, particularly of proteins, and the excessive use of alcohol, condiments, spices, and coffee, are potent factors in bringing about this condition. An acute form of the congestion may be brought on by excessive eating and drinking; alcoholism being the most common. (Occasional "spree.") Various toxic or poisonous substances, both endogenous and exogenous, may be carried to the liver by the portal circulation and set up an active congestion. Among the endogenous are the toxins and products produced in disease of the gastrointestinal tract, such as dysentery, typhoid, gastroenteritis, and other acute infections. Of no little importance in this connection are the chronic intestinal intoxications and constipation. The presence of the products of bacterial metabolism, exogenous and endogenous toxins and split proteins, probably at first cause a chronic active congestion due to the increased functional activity necessary to neutralize these toxins, followed by an inflammatory reaction due to the continuous irritation, which may eventually advance to the stage of cirrhosis. The toxins of general infections—such as influenza, malaria, typhoid—and acute respiratory infections may be brought there through the general circulation. Of the exogenous poisons, ptomaines and preformed and ingested food poisons, phosphorus, arsenic, lead and other mineral poisons are the most important. In tropical countries an acute congestion of the liver is found, following exposure or "cold," but whether this is primary or is secondary to infection is still a question. It is thought by some that reflex circulatory and vasomotor changes may take place associated with disturbances of menstruation, climacteric, and other similar conditions.

Symptoms. The symptoms of active congestion correspond closely to those of the so-called "bilious attack." Following an unusually large meal or a drinking bout, the patient complains of loss of appetite, a bad taste, epigastric distress, or a sense of fullness or discomfort in the right hypochondrium, increased by taking food. Headache, malaise, irritability, nervousness, insomnia, vertigo, and nausea, are often present. Vomiting is occasionally present. The tongue is furred, the breath foul, and there may be a subicteric or sallow tint to the sclera and face. There is usually constipation but occasionally diarrhea is present. The liver is enlarged and tender. The attack usually lasts three or four days and in itself is not serious but the enlargement is subject to recurrences and may be the first stage of cirrhosis. Its etiological factors are therefore of importance.

The *diagnosis* is usually not difficult. The symptoms enumerated above, namely, tender liver without jaundice, following an indiscretion in diet, alcoholism, exposure, etc., give a fairly characteristic picture.

Treatment. The prophylactic treatment obviously is to correct the etiologic factors. The food eaten should be moderate in amount, well cooked, and the diet low in protein. Condiments, spices, and alcohol, should be avoided. In those cases which are secondary to an intestinal toxemia, this condition and constipation must be corrected before permanently good results in the liver can be expected. Laxative foods and the use of vaselin or mineral oil are preferable to cathartics. An occasional transduodenal lavage with a liter of hypertonic saline solution or saline cathartic is also beneficial. Plenty of exercise in the open, baths, massage, sufficient rest, other hygienic measures, and tonics, very often aid these cases greatly.

During the acute attack the patient should be at rest in bed. Food is restricted to a minimum. At first small amounts of milk are given at infrequent intervals and after the first twenty-four hours it may be gradually augmented by whey, junket, albumin water and jelly. Later, cereals may be added and finally meat. Free watery catharsis by salines is helpful during the early stage. Ammonium chloride (20 grains three times a day) is believed to prevent congestion, relieve catarrh,

and stimulate elimination of waste products such as urea, uric acid, etc. In the early stages it should be used with alkalies and later it may be combined with nitro-hydrochloric acid, nux vomica, and a bitter tonic. For gastric irritability, bismuth, soda bicarbonate, bromides, carbolic acid, or creosote, may be given.

Passive Congestion.

This is due to an interference with the outflow of blood and is usually cardiac in origin but occasionally may be caused by other conditions which obstruct the flow in the vena cava and hepatic vein or pulmonary artery, such as deformities of the spine (kyphosis and scoliosis), intrathoracic tumors, hydatid cysts, gummata, pleuritic and peritoneal effusions, aneurism, and inflammatory bands and adhesions. Of cardiac conditions causing this condition, mitral stenosis is the most common, but cardiac disease of any type—valvular or myocardial—in the later stages causes insufficiency of the right heart and stasis or impeded flow in the vena cava. Such diseases of the lungs as emphysema, chronic bronchitis, asthma, chronic interstitial pneumonitis, chronic adhesive pleuritis, and pleural effusions, increase the work of the right heart and cause dilatation with subsequent passive congestion of the liver.

Pathology. The liver may be greatly enlarged, in some cases extending to the umbilicus. In the early stages the hepatic veins and their intralobular branches and capillaries are distended and filled with blood, the dilatation extending a variable distance toward the periphery of the lobule, depending on the duration and severity of the disease. Small hemorrhages are not uncommon. After the hyperemia has existed some time the hepatic cells about the central veins become atrophied due to pressure and malnutrition. Fatty infiltration becomes prominent and in some cases may be excessive. The liver cells about the veins also contain a variable amount of pigment. Following the atrophy there is a relative and absolute fibrosis, beginning at the center and extending toward the periphery of the lobule. Later, induration and contraction of the fibrous tissue takes place and the liver may be very much reduced in size.

Symptoms. The symptoms of passive congestion are usually referable to the primary condition. Where it is due to cardiac insufficiency there may be cyanosis, albuminuria, edema, or ascites, depending on the severity of the disease. The ascites may be part of a general dropsy, in which cases it is small in amount. Later it is due to portal obstruction and becomes very marked and may require repeated tapping for relief. Early in the disease symptoms referable to the liver may be limited to a feeling of weight or fullness in the right hypochondrium and minor digestive disturbances. As the congestion progresses the digestive symptoms become more pronounced. There is loss of appetite, distention, and flatulence, constipation, epigastric distress, and nausea. Usually there is a slight degree of jaundice. This, however, may vary from a slight subicteric tint to a very deep jaundice. The liver is large and tender, sometimes reaching several inches below the costal margin.

The *prognosis* in this condition depends entirely on that of the primary disease. The local condition in the liver itself is readily amenable to treatment in the early stages of cardiac disease and improves with the heart condition, but after the heart has become permanently incompetent the outlook is bad. Late in the disease the cirrhotic liver may diminish in size, the symptoms become more severe, ascites is frequent, and symptoms of icterus gravis often supervene.

Treatment. The treatment is directed toward the primary condition. In the cardiac and pulmonary cases the patient must be at complete rest. The diet should be light and nutritious. A milk diet has been recommended. Fluids are restricted. Digitalis with other heart stimulants, aided by diuretics, are very helpful in reducing edema and ascites. Tapping for ascites should not be delayed too long where there is distress, and repeated tapplings may be necessary for comfort. Free catharsis by saline purgatives or Carlsbad, and later mercurial and vegetable purgatives, are useful aids in reducing edema. Bleeding and leeches have also been advocated. A hot or cold application over the liver may relieve the distress.

Organic Disease of the Hepatic Vessels.

Rarely the hepatic artery may be dilated in conditions which obstruct the vena cava, in which case it acts as a compensatory mechanism but is never efficient. Dilatation is also present in cirrhosis of the liver. Thrombosis, aneurism, and arteriosclerosis, have been described but are extremely rare conditions and are never diagnosed during life. Dilatation of the vein occurs in chronic enlargement of the right heart and is present in passive congestion of the liver. The walls become thick, and a perivascular fibrosis with atrophy and pigmentation of the liver cells results. Thrombosis and suppurative phlebitis may occur but are also rare.

Thrombosis of the Portal Vein.

While this is most commonly found in cirrhosis of the liver, it may also be due to syphilis of the liver, invasion by cancer, phlebitis, inflammatory disorders, and conditions which impede the circulation. A diagnosis of this condition is rarely made. However, it should be suspected when there is sudden intense engorgement of the branches of the portal system with hematemesis, melena, swelling of the spleen, and ascites. The ascites is marked and usually rapidly recurs after tapping.

ACUTE PERIHEPATITIS.

Acute perihepatitis is an inflammation of the peritoneum covering the liver, which may be local or diffuse, and fibrinous, serofibrinous, or purulent. This condition is always secondary to preëxisting disease of the liver or adjoining viscera. It may follow traumatism of the right side, fractured ribs, contusions, and laceration or contusion of the liver. More often it follows acute congestion and inflammation of long-standing, chronic passive congestion, suppuration, tuberculosis, gummas and new growths of the liver which may extend toward the capsule. Occasionally it is associated with ulcer of the stomach, duodenum, and intestine; cholecystitis, cholelithiasis, pancreatitis, appendicitis, pleuritis, and pericarditis. It is always due to bacterial infection, the most common types being *Bacillus coli*, staphylococcus, streptococcus, pneumococcus, and *Bacillus proteus*.

Pathology. Following injury or infection, the vessels of the peritoneum become hyperemic and distended and an inflammatory exudate is thrown out. It may be serous, serofibrinous, or purulent. In the milder cases the exudate may be absorbed or organized with little change to the peritoneum. In more severe cases and those of longer duration the exudate becomes organized, producing adhesions between the superior surface and diaphragm and anterior abdominal wall; and in those cases which follow disease of adjacent abdominal organs between the inferior surface and the contiguous organs. In some cases the lesion progresses to suppuration, when it really becomes a localized purulent peritonitis which often cannot be distinguished from such conditions as subphrenic abscess.

Symptoms. Pain in the right hypochondrium is the most characteristic symptom. It is often acute and lancinating. It may be located over the region of the liver, epigastrium, along the costal border, in the axilla, or may be referred to the right shoulder or the supraclavicular space. The latter is claimed by Cantho to be diagnostic. The pain is increased by movement, such as respiration, lateral position, etc. A friction rub may often be detected by auscultation and more rarely by palpation. Nausea and vomiting are not uncommon when adjoining viscera are involved. There may be rigidity and tenderness of the muscles of the right side. Frequently there is fever, usually associated with a leucocytosis.

The *diagnosis* usually is not difficult when to the signs of the primary disease are added pain and tenderness in the right hypochondrium with an audible and palpable friction rub over the liver. It must be differentiated in some cases from right-sided pleurisy, but the absence of primary abdominal disease, higher position of local signs, and no pain on passive motion of the liver, make the location of the disease clear.

The local condition in itself is not serious and is rarely fatal. The prognosis depends entirely on the primary condition.

Treatment. The treatment is directed to the primary condition. The patient is kept at rest on a light diet until the acute condition has subsided. Strapping, ice-bag, poultices,

counter-irritation, etc., often give relief from pain. However, in a few cases opium or other sedatives may be required.

CHRONIC HYPERPLASTIC PERIHEPATITIS.

Chronic hyperplastic perihepatitis is a chronic productive inflammation of the capsule and peritoneal covering of the liver. It occurs in both sexes with about the same frequency and principally between the twentieth and sixtieth years. The condition is thought to be due to some form of general toxemia, the exact nature of which is not understood. It is often associated with arteriosclerosis, nephritis, tuberculosis, syphilis, malaria, typhoid, and other infectious diseases. By some it is thought to be due to selective action of a toxin or toxins for the serous membrane, and by others to a predisposing susceptibility of these membranes.

Pathology. The condition is essentially a multiple serositis, the liver involvement being but a part of a generalized chronic peritonitis, pleuritis, and pericarditis. One, two or all of the membranes mentioned may be involved in the process, and it may begin in either of them, but is thought in most cases to originate in the abdomen, then extend to the right pleura, left pleura, and finally to the pericardium.

The liver is covered by a dense, white, glistening fibrous layer of connective tissue, which can be peeled off in layers and leaves a more or less intact peritoneum. The process usually is not limited to the surface of the liver but often involves the gall-bladder and other adjacent organs. Often the spleen is invested in a thick covering of the same fibrous connective tissue. This tissue has a marked tendency to contract and produces deformities of all organs involved, the adhesive bands in some cases attaching coils of intestine to each other and to various organs, sometimes producing obstruction.

Usually the parenchyma of the liver is without lesion unless the perihepatitis is associated with previous disease of this organ, such as cirrhosis. The kidneys usually show evidence of chronic interstitial nephritis and may be congested.

Symptoms. The symptoms of the disease are variable. In many cases there are no subjective symptoms and the condition is not discovered during life, or is found only during the course of a thorough examination. The condition is

chronic and may be present for years before it is suspected. There may be a sense of weight or oppression in the upper abdomen, occasionally pain is present. The principal feature of the condition is a marked ascites. It is excessive, recurs rapidly, requires very frequent tapping, and yet the general condition of the patient often remains good. The fluid is amber in color, of high specific gravity, and contains a large amount of albumin—up to three per cent. in some cases. Examination of the urine often reveals the presence of congestion of the kidney and interstitial nephritis. Later, signs of the involvement of the pleura and pericardium become noticeable, with cough, edema of lower extremities, and other signs of myocardial insufficiency develop, and finally in most cases the heart fails and death may be due to pneumonia or other intercurrent infections.

The *diagnosis* depends on rapidly recurring ascites in a patient who remains in fairly good general condition, is able to be up between attacks, and who may have a history of an earlier attack of pericarditis, pleuritis or perihepatitis with transient edema of the legs. The signs of an obliterated pericardial cavity are often present, and Broadbent's sign in the back may be positive.

It is differentiated from cirrhosis of the liver by absence of adherent pericardium, etiology, late appearance of ascites, less frequent tapplings; from lues hepatitis by anamnesis, and Wassermann reaction; from tuberculous peritonitis by fever, less exudate, tuberculosis elsewhere; from carcinoma hepatitis by nodular enlargement, and rapid course.

The ultimate prognosis is bad. The cases run from two to twenty years but the majority die from cardiac insufficiency or intercurrent disease before the tenth year.

Treatment. The treatment is symptomatic. The ascites requires frequent tapping and as time goes on the intervals become shorter. Between tapplings the patient may be able to be up and take care of business. Diuretics and salines may be tried but usually have little influence on the ascites. As cardiac and associated symptoms arise they are treated with digitalis and other heart tonics.

DEGENERATIVE CONDITIONS OF THE LIVER.

Fatty liver is a condition in which the liver is greatly enlarged, of a yellow color, and contains a great excess of fat—often as much as thirty or forty per cent. instead of the normal one to five per cent.

The increase of fat may be of two types: infiltrative and degenerative. The infiltrative type is commonly found in obesity and alcoholics. The degenerative type may be found associated with chronic diseases, such as tuberculosis, severe anemias, and the cachexia of cancer. A mixed form occasionally occurs with infectious diseases, phosphorus poisoning, and other intoxications such as arsenic, mercury, and copper.

There are no subjective symptoms except those incidental to the primary condition, or there may be slight digestive disturbances. The liver is enlarged, soft, and the edge and surface are smooth. Icterus is absent and the spleen is not enlarged.

Amyloid degeneration often occurs during chronic wasting diseases. It follows such conditions as chronic suppuration, tuberculosis, syphilis, chronic ulcers, rickets, prolonged convalescence from infectious diseases, and cachexia of cancer.

The amyloid liver is large, solid, firm, resistant; on section anemic, and has a translucent, infiltrated appearance. It is usually associated with amyloid degeneration in other organs, including the kidney, spleen, intestines, etc.

The subjective symptoms in this condition are not marked. The liver is large and hard, with rounded margin and smooth surface. There is no jaundice, ascites, or tenderness. The spleen is enlarged and hard. There usually is albuminuria and often diarrhea.

A progressively enlarging painless liver during the course of chronic cachectic diseases, such as tuberculosis of the lungs or bone, chronic suppuration, osteo-myelitis, lues, malaria, ulcers of the leg, cancer, etc., makes a diagnosis of amyloid degeneration tolerably certain, especially if there is albuminuria with hyaline casts, and diarrhea.

Other degenerative conditions occur which are more of pathological interest than clinical importance.

LIVER ABSCESS.

Abscess of the liver is a suppurative condition due to infection by pyogenic microorganisms. The most common of these are: *Bacillus coli*, *Bacillus dysenteriae*, *Entameba dysenteriae*, *Bacillus typhosus*, *Bacillus pyocyaneus*, *Bacillus proteus vulgaris*, streptococci and staphylococci.

The infection is usually differentiated into two classes: the single, or so-called tropical abscess, and multiple abscesses; but these are fundamentally a similar process. They are sometimes further classified as primary, when caused by injury to the liver or by direct extension from adjacent organs, and secondary (metastatic, pyemic, etc.), when the original focus is at some distance from the liver.

Primary liver abscess is not very common. Occasionally it follows rupture or contusion of the liver and injuries to the chest or right side and probably is due to a lowering of the local resistance in the liver. In other cases the infection may be introduced by stab or bullet wounds. Rarely the abscess is produced by direct extension from adjacent organs, but occasionally a gastric or duodenal ulcer may form adhesions between the stomach and duodenum and liver, perforate and cause infection of the liver tissue. Similarly it may occur with cholecystitis and cholelithiasis, but the infection from this source is more often carried by lymphatics or by direct extension through the biliary channels and then belongs to the secondary group.

The portal vein is the principal pathway for infection in the *secondary* group. The digestive tract is peculiarly prone to ulceration and infection. As the result of localized inflammation of abdominal viscera, the smaller branches of the portal vein may become thrombosed and later infected. Small infective emboli are thrown off which produce a condition of pyemia in this vein. The emboli and bacteria are stopped in the small veins of the liver and are the starting point of metastatic abscesses.

Many cases of liver abscess follow the acute infections of the intestines, particularly dysentery (amebic and bacillary) and typhoid. Other ulcerative conditions of the small intestine and colon, such as ulcerative colitis, not infrequently

precede the abscess. Probably the chief focus or source of the infection is the appendix. Many cases of pylephlebitis follow appendicitis. The thrombus may become infected, infective emboli be carried to the liver and metastatic abscesses result. In other cases the suppurative pylephlebitis may produce the abscess by direct extension. More rarely organisms may be carried to the liver from the appendix through the lymphatics.

Secondary abscesses may also follow pelvic suppuration, puerperal infection, and infected hemorrhoids. In fact, infection of any part drained by the portal vein may be the source of liver infection.

The infection more rarely is brought through the hepatic artery. In these cases the liver infection is usually a part of metastatic infection in a general bacteremia and pyemia, which frequently are the sequellæ of ulcerative endocarditis, lung abscess, bronchiectasis, etc.

Infection through the hepatic veins is quite rare although cases have been described in which infected emboli from the vena cava have entered the hepatic vein.

Liver abscess has often followed suppurative cholecystitis and cholelithiasis. From the infected gall-bladder and lower ducts the infection ascends, producing a cholangitis involving the intrahepatic portion of the ducts and results in multiple small abscesses. The gall-bladder and liver are closely connected by an extensive lymphatic system through which the infection may easily be carried from one to the other.

Single abscess due to pyemia, pylephlebitis, etc., is rare but occasionally occurs if there be a single embolism, by direct extension and following traumatism. It sometimes is found associated with hydatid cyst of the liver.

Pathology. The liver may appear normal but often is enlarged and congested, with spots of yellow or red showing beneath the capsule. The characteristics of the individual abscess are similar to those in other organs. At the point of infection a focus of necrosis is located surrounded by the so-called pyogenic membrane. As the process goes on, the necrotic center enlarges and contains leucocytes, necrotic liver cells, pigment, bacteria and detritus, while the liver cells at the periphery undergo a process of liquefactive necrosis

and the inflammatory reaction extends. The abscesses are usually multiple and may be very numerous. On section they appear as softened yellowish or grayish-yellow spots, which vary in size from very minute areas to others that are several centimeters in diameter. The abscesses may appear discrete but often several are found to coalesce, frequently with a dendritic appearance. They are found in most instances to be connected with the smaller branches of the portal vein. The pus when squeezed out may be thick, yellow, and creamy, or it may be bile stained and fetid, depending upon the causative organism and type of infection. In the cases resulting from obstruction and infection of the bile ducts, these ducts are greatly distended with bile and pus.

The *tropical or amebic abscess* is often single and large, but there may be many small ones. Occasionally the liver may be studded with small miliary abscesses. In the early stages the abscesses are grayish-yellow with sharply defined contours and contain a spongy necrotic material with more or less fluid in its interstices. Occasionally the contents may be sterile, similar to that of a "cold abscess." The larger abscesses have ragged necrotic walls and contain a more or less viscid, greenish-yellow or reddish-yellow purulent material, mixed with blood and shreds of liver tissue. The older abscesses have dense, tough fibrous walls. A section of the abscess wall shows an inner necrotic zone, a middle zone in which there is a great proliferation of connective tissue cells and compression and atrophy of the liver cells, and an outer zone of intense hyperemia.

The abscess when single (over sixty per cent. of cases) is usually located in the right lobe and there may be enlargement and swelling of this part of the liver.

Symptoms. The symptoms of solitary abscess may be latent and indefinite; death may come suddenly from rupture. In tropical regions the signs of liver congestion, pain and enlargement, may be present for a day or two and disappear. In many cases the onset is insidious. There is malaise and slight pain in the right hypochondrium and slight irregular, intermittent and remittent fever, which may be mistaken for malaria. In other cases the symptoms are more severe. The temperature is elevated at the outset and

may rise to 103° F. or higher. Usually it is of an intermittent or septic type and irregular, often preceded by a rigor. Profuse sweating is common, especially during sleep. The pain is variable and may be located over the liver or referred to the back or right shoulder, which is increased by turning to the left side and the patient prefers to lie on the right side. Usually there is tenderness over the liver on pressure. The enlargement is usually in the right lobe, which is the most often involved. Sometimes the enlargement is quite marked, extending several centimeters below the costal margin, or it may not be appreciable. Liver dullness may be increased upward when the abscess is suprahepatic. Loss of appetite and anorexia are common. If the abscess is near the surface and the inflammation involves the peritoneum on and near the diaphragm, there may be nausea, vomiting and hiccough.

After the abscess is once formed it tends to remain stationary for weeks and sometimes months, but most commonly at about the end of three weeks it tries to make its way outward. In these cases which tend to be chronic there may be marked emaciation, weakness and anemia. When the abscess is near the surface there is usually a localized perihepatitis which may be indicated by an audible or palpable friction rub.

The skin has a sallow, slightly icteroid tint, the face is pale, the complexion muddy, the conjunctivæ are injected and often slightly bile tinged. Marked jaundice is rare. There may be diarrhea or constipation.

The abscess may perforate into the lung, which is indicated by cough, expectoration of material of a reddish-brown or brick-dust color, and involvement of the base of the right lung. It may also perforate into the stomach, intestine, peritoneum, pericardium, or externally through the skin.

It may run its course in six or eight weeks, or it may last for years. The prognosis is serious, as the mortality is more than fifty per cent.

The symptoms of pyemic abscess and pylephlebitis are those enumerated above, plus signs of septic infection. The liver is enlarged and tender. There are chills, sweats, prostration, and septic fever. The complexion is muddy and sometimes distinctly icteroid.

Diagnosis. Liver abscesses may be mistaken for malaria, due to the intermittent type of fever. The absence of parasites in the blood, and resistance to quinine, however, tend to differentiate them. It may also simulate the intermittent fever sometimes associated with gall-stones. However, the gall-stone attack is of shorter duration, has periods of apyrexia, and is accompanied by a progressive jaundice during the attack; the abscess of the liver, being secondary in most of the cases, there is a history of ulcer or infection in the intestinal tract.

As an aid in diagnosis, exploratory puncture may be performed. It is advisable to do the puncture under anesthesia because it may be necessary to do several of them. The needle may be entered in the anterior axillary line in the lowest interspace, or in the seventh interspace in the mid-axillary line, or over the area of dullness behind. A fair sized aspirator should be used. It may be unsuccessful after several punctures even though abscesses are present. No ill effects follow this procedure, even though blood may leak into the peritoneal cavity.

Pyemic abscess and pylephlebitis are invariably fatal.

Treatment. The general medical treatment for multiple abscesses is that for septicemia. Plenty of light, easily assimilated nourishment, and general tonics and stimulants are given. Surgical interference is rarely successful unless the abscess is single.

The abscesses associated with dysentery are often single and are, therefore, more amenable to surgical treatment. Emetin hydrochloride, in doses of three-quarters grain hypodermically, or ipecacuanha, in capsules or by rectum, are very valuable adjuncts to surgical treatment, and if used persistently during the primary disease, may prevent the formation of the liver abscess.

ACUTE YELLOW ATROPHY.

Acute yellow atrophy is an acute affection of the liver, characterized by extensive necrosis of the liver cells, jaundice, severe toxic symptoms, and usually a fatal termination.

Acute yellow atrophy, or icterus gravis, is a comparatively rare disease. Most of the cases occur between twenty and

forty years of age. The disease is of two types: the primary, in which a previously healthy individual is suddenly taken ill; and the secondary, which occurs during the course of other diseases, the latter being much more common.

The exact cause of this acute necrosis is not known but it seems to be due to various forms of intoxication.

Over half of the cases occur in women and the majority of these are found during middle and late pregnancy. The onset in these cases has been preceded by shock, fright, mental disturbance, worry and anxiety, all of which have been thought to be etiological factors but probably have no more effect on the process than to lower the patient's general resistance.

It is also found associated with infectious diseases. About ten per cent. of the cases occur during secondary syphilis, and it may occur late in acute infections such as typhoid, diphtheria, malaria, osteomyelitis, and erysipelas. Several organisms have been found infecting the liver, including *Bacillus coli*, streptococci, staphylococci, pneumococci, and *Bacillus proteus vulgaris*. However, they are not constant and may be secondary.

The disease also may follow cirrhosis, especially the hypertrophic form, and alcoholism. Non-bacterial intoxication, including delayed chloroform poisoning and phosphorus poisoning, produce conditions very similar to acute yellow atrophy, clinically resembling it very closely.

Pathology. The toxic substances cause an anatomical and physiological decay of the cells of the liver, with or without atrophy of the organ. The liver is not only attacked in its histological elements but also in the chemical constitution of its parenchyma; the hepatic cell may be physiologically destroyed while the morphological changes appear to be slight. The functional activity of the liver is suppressed, glycogenesis is abolished, and there is rapid decay of the nervous, vascular, and muscular systems. Toxins and digestive products brought by the portal vein are no longer neutralized, extractives in the form of urea no longer undergo their final oxidation, and the bile acids are incompletely elaborated.

The liver is greatly reduced in size, sometimes being less than one-third of the original volume and weight. The capsule is wrinkled and often thickened. The surface of the liver may be greenish-yellow or a dirty dark gray in color, with numerous patches of red or reddish-brown, and sometimes small hemorrhages are seen. In cross-section, the color may be yellowish-red, yellowish-brown, or mottled.

The lobules are indistinct. Microscopically there is widespread destruction of liver cells, which may be seen in all stages of necrosis, usually beginning at the periphery of the lobule and extending toward the center. In places they seem to have been completely destroyed, and are represented by a fatty granular *débris* with pigment grains and crystals of leucin and tyrosin, so that it scarcely can be recognized as liver tissue. Small hemorrhages between the liver cells are not uncommon. The lining cells of the smaller ducts become smaller and more or less necrotic, and there may be an obstruction in these ducts which adds to the jaundice. Most of the organs of the body are bile-stained and may be the seat of numerous hemorrhages. The spleen is enlarged and soft. The kidneys may show a marked granular degeneration of the epithelium. An early stage of parenchymatous nephritis is always present. The blood is in an abnormally fluid state and has little tendency to coagulate. It also contains a large amount of leucin, tyrosin, xanthin, and a decreased amount of urea. There may be hemorrhages in the pleura, lungs, and the capsule of the liver, spleen and kidneys.

Symptoms. The early symptoms of acute yellow atrophy are not of a distinctive character. In the primary type, the onset is insidious. An individual in good health complains of symptoms resembling the invasion of influenza or typhoid fever. For a few days there is lassitude, malaise, pains in the limbs, prostration and low spirits. In other cases it begins and appears as a simple catarrhal jaundice, the more severe symptoms developing a few days later. Sometimes it begins with a violent rigor, accompanied by extreme prostration, rachialgia, and vomiting, but this type of onset is more rare. At other times gastrointestinal disturbances are the most prominent feature. The malaise, however, increases;

fever appears, and from the third to the eighth day icterus sets in, followed by the more severe symptoms.

During the course of typhoid fever, pneumonia, malignant syphilis, syphilis of the liver, cancer of the liver, cirrhosis, gall-stones or pregnancy symptoms of acute yellow atrophy may appear and may be thus secondary to, or an episode in, the course of the conditions mentioned.

The chief symptoms of the later stage of acute yellow atrophy are icterus, hemorrhage, and nervous phenomena. The icterus varies from a very light yellow tint in the conjunctiva and skin, to a bright yellow or greenish-yellow. The color does not bear any relationship to the severity of the disease. As the disease progresses the icterus may disappear, which is a bad sign, showing decay of the hepatic cell.

Hemorrhages are a very prominent feature. Epistaxis is very common and occurs early. There may also be purpura, bleeding from the gums, hematemesis, and melena; hematuria, hemoptysis, and metrorrhagia, are more rare. The blood is very fluid, the coagulation time is greatly increased and bleeding is difficult to control.

The nervous symptoms may be those of depression or excitation. There may be sleepiness, stupor or coma; or there is headache, restlessness, delirium, dyspnea, hiccough, insomnia, tremor of the lips, and convulsive movements.

The depression and excitation may alternate or be present together in the same case. Often the disease begins with depression but later symptoms of excitation develop, followed by coma.

The temperature and pulse are variable. There may be hyperthermia or hypothermia, or the pulse may be fast or slow, and there are intermediate states, but a subnormal or normal temperature and rapid pulse are most common.

Nausea and vomiting are constant symptoms and there may be hematemesis. The tongue is dry and furred, and diarrhea may be present. In the early stages the liver may be normal or slightly enlarged and tender, but later it diminishes until in some cases the liver dullness is entirely obliterated. In many cases palpation reveals an enlarged spleen.

The urine is decreased in amount, highly colored, high specific gravity, and usually contains a small amount of

albumin and hyaline, granular, fatty and epithelial casts. Leucin, tyrosin and other amino acids; lactic, acetic, butyric and other fatty acids, are present in the majority of cases. There is also a decrease in the amount of urea excreted, and an increase in the ammonia and other nitrogenous substances. Bile pigment and urobilin—sometimes both, depending on the amount of bile reaching the intestines—are usually present.

The stools at first contain bile but later become lighter colored until they may be typically clay-colored from complete absence of bile. They are usually offensive and melena is present in many cases.

The disease is practically always fatal, usually between the fifth and tenth days. Some cases terminate rapidly and death occurs on the second or third day; others become more chronic and may extend for a few weeks. Rarely a case recovers. The prognosis is particularly bad in pregnant women. When the disease is fully developed the vomiting, nervous symptoms, delirium, hemorrhages, decreasing tender liver, and the presence of leucin and tyrosin in the urine, are unmistakable.

The early diagnosis of acute yellow atrophy is very difficult because of its insidious onset and similarity to benign icteric diseases and states. However, when jaundice associated with a tender liver appears during pregnancy, this condition should be suspected at once, since more cases are associated with this state than any other one factor.

Treatment. Therapeutic measures have little influence on the course of the disease. The treatment is purely symptomatic and theoretical, *i.e.*, to eliminate all possible toxin formation, etc. The patient is put to bed and kept on a milk diet supplemented by a limited amount of carbohydrates. Free catharsis, by calomel and salines, is instituted and fluids are forced—plain or alkaline mineral waters are probably best. Alkalis and diuretics may be given in an effort to control the intoxication. Enteroclysis, hypodermoclysis, and intravenous use of large amounts of saline, may be used. Intestinal antiseptics have been advocated but probably are not very efficient in checking the cause of the atrophy.

LUES HEPATIS.

The liver may be affected in both congenital and acquired syphilis. Besides those cases in which the liver is found involved at birth, there are latent cases or so-called syphilis hereditaria tarda. A few of these cases are found in adult life, although most of them develop during childhood.

The symptoms of the *congenital type* are not distinctive but may simulate simple catarrhal jaundice, perihepatitis, active congestion, and other liver conditions. There is usually moderate enlargement of the liver, which may be quite tender on pressure. Anorexia is common and occasionally nausea and vomiting. The spleen is often enlarged and there may be ascites. These cases practically always show other signs of congenital syphilis, such as rhagades, fissures of mouth and anus, ulcer scars, deformities, prematurely old appearance, infantilism, Hutchinson teeth, etc. The Wassermann reaction is positive.

Acquired syphilis may involve the liver during the secondary stage, but more commonly in the tertiary stage.

During the secondary stage jaundice may occur coincident with the rash and enlarged superficial glands. The color varies from light to deep yellow and the stools may or may not be colorless. The jaundice may occur as an isolated symptom but usually is accompanied by digestive disturbances, diarrhea, and general symptoms of this stage of the disease and the associated jaundice, such as headache, fever, malaise, and lassitude. It is thought that the jaundice is due to catarrh of the ducts and acute general interstitial hepatitis.

It may progress to a condition of icterus gravis or acute yellow atrophy.

The diagnosis is made on the history of specific infection; the presence of the papular, squamous or lenticular syphilides and also syphilides of the throat, mouth, vulva, or anus; crusts of the scalp, and adenitis of the groin. The Wassermann reaction is usually positive, but may be negative in the early part of the second stage.

Tertiary acquired syphilis occurs in the form of gummata or as a fibrosis. The two lesions are usually associated, although one type may predominate. The fibrosis often re-

sembles cirrhosis. The liver is hypertrophied or atrophied, nodular, dark brown, and lobulated. Microscopically the liver shows a mixture of portal and hypertrophic cirrhosis. The arterioles are affected by endarteritis. The cirrhotic tissue surrounds the lobule and penetrates into it. In the gummatous type gummata are found on the surface and in the parenchyma of the liver. They vary in size, but rarely are more than two to three centimeters in diameter. Later they are invaded by fibrous tissue and contract, those under Glisson's capsule making stellate cicatrices.

Perihepatitis is more common and more extensive in syphilis of the liver than in any other form of chronic hepatitis. It is usually very extensive, with the formation of dense bands of adhesions between the liver and abdominal wall and neighboring viscera.

Symptoms. The onset is often insidious and the symptoms indefinite. A few years after the primary lesion the patient begins to have slight digestive disturbances. The appetite is poor, the digestion is at fault, loss of flesh progresses, and diarrhea, edema of the feet and legs, and loss of strength appear. There is often an icteroid tint, but true jaundice is not common. Ascites and collateral circulation also are not common, unless late in the process. In thin subjects without ascites, a palpable or audible friction rub of the perihepatitis may be detected over the liver. The liver may be atrophied or hypertrophied, and the edge is irregular and nodular. The spleen is usually enlarged.

The disease may simulate cirrhosis, tumor of the liver, and nephritis with an enlarged liver. The age of the patient, anamnesis, and positive Wassermann reaction, usually make the diagnosis clear. The potassium iodide therapeutic test may be of considerable value in doubtful cases.

Treatment. The treatment is that of syphilis in general. Courses of mercury, salvarsan, and potassium iodide, are given together, or one may be used during the resting interval of the other. The prognosis in most cases is good, providing the cirrhotic changes have not progressed too far.

TUBERCULOSIS OF THE LIVER.

Tuberculosis of the liver is frequently secondary to tuberculosis of the lungs, alimentary tract, peritoneum, and abdominal viscera. It is rare as a primary condition. Usually the infection is part of a general acute miliary tuberculosis and the liver contains multiple minute tubercles. Miliary tuberculosis of the liver may also be found associated with chronic tuberculosis elsewhere in the body. In these cases the infection is thought mainly to be through the general circulation via the hepatic artery, but it may also be carried by the portal system, lymphatics, and bile ducts.

Solitary tubercles occur as large tuberculous masses sometimes associated with tuberculous peritonitis, perihepatitis, adenitis, and tuberculous disease of adjoining viscera, from which it progresses by direct extension. The organ is enlarged, with a rough edge, tender, and associated with jaundice. The nodule may undergo softening and caseation, and very often becomes infected by secondary organisms.

Tuberculous angiocholitis is not an uncommon form. There are numerous small peribiliary tubercles which tend to become caseous and form small cavities. The contents of the cavities are bile-stained and may be infected with secondary intestinal organisms. The walls of the duct are studded with fine granules. The liver is usually enlarged and tender.

Associated with the *multiple or miliary tubercles* there may be an increased formation of connective tissue, to which condition the name of tuberculous cirrhosis of the liver has been given. There may also be a fibrous overgrowth with other forms of chronic tuberculosis of the organ. It often occurs during the course of tuberculous peritonitis and perihepatitis. Several forms have been described but the disease is comparatively rare. Fatty degeneration and infiltration occur very often. It may be local and form a concentric zone about the tubercle or it may be general.

Symptoms. Clinically hepatic tuberculosis is usually silent in its progress and the condition is not often diagnosed during life. Occasionally, during a careful examination of a patient with tuberculosis, the liver is found to be moderately enlarged and tender, the border sometimes extending two or

three finger-breadths below the false ribs. The spleen is also somewhat enlarged. Slight jaundice, some decoloration of the feces, scanty and brick-colored urine, urobilinuria, and alimentary glycosuria, show that the liver is diseased. The anatomical type, however, cannot be determined.

Fatty hypertrophic cirrhosis is usually found in a patient showing signs of gastrointestinal alcoholic catarrh, catarrh of the mucous membranes with expectoration or vomiting of mucus, anorexia, vomiting, slight swelling of the liver, and scanty urine loaded with urates. On these symptoms are engrafted those of pulmonary tuberculosis, which become quite prominent. Later some alcoholic excess, chill, or fresh outburst of tuberculosis, causes a marked increase in the severity of the symptoms. The anorexia is complete, the skin assumes a yellow tint, the urine becomes scanty with but little urea, though urobilin, sugar or albumin may be present. The fecal matter may be colorless; epistaxis, hematemesis, and other hemorrhages occur; and the patient becomes profoundly asthenic. Ascites is negligible and the subcutaneous veins are not much dilated, as a rule. The liver is markedly enlarged, hard, smooth, and painful on the slightest pressure.

The appearance of abdominal pains, tenderness over the enlarged liver on pressure, marked jaundice, and cachexia, are especially observed in tuberculous cirrhosis. Advanced signs of pulmonary tuberculosis or of tuberculous peritonitis are most important for a diagnosis of this condition.

Treatment. There is no special treatment for tuberculosis of the liver, but it is the same as that of the general disease.

NEW GROWTHS OF THE LIVER.

Carcinoma.

Carcinoma is the most common tumor of the liver. It is found chiefly in later adult life (forty to sixty years) and occurs with about equal frequency in men and women. The growth may be primary or secondary.

Secondary carcinoma of the liver is by far the most common form. It may follow carcinoma of the stomach, intestines, rectum, gall-bladder, lungs, uterus, bones, skin, and choroid. It may be columnar-celled epithelioma, encephaloid, scirrhus,

hematoid, colloid, or melanotic carcinoma, according to the rule that a secondary cancer is always the same kind as the primary growth.

Pathology. The encephaloid form and cylindrical epithelioma are the most frequent. The secondary cancers, instead of forming a single mass like primary massive cancer, form islets that are more or less spherical, mammilated, varying in size from a millet-seed to an orange, and disseminated throughout the organ.

The organ increases to an enormous size and may reach thirty or more pounds in weight.

Cancerous nodules project beneath the capsule and may be palpated or even seen in thin subjects during life. They are usually disseminated equally but may be confined to one lobe. The consistence of the nodules varies. They may be hard and firm or, in some cases, they are softer and umbilicated due to degeneration, softening and shrinking of the central portion.

The growth invades all the elements of the lobule, including cells, vessels, biliary canals, and connective tissue. The hepatic cells at the periphery of the growth are deformed, spindle-shaped, hypertrophied and swollen by accumulations of protoplasm. The interlobular connective tissue loses its fibrous appearance and becomes infiltrated with embryonic nuclei. The ramifications of the portal vein and hepatic artery are invaded, the walls infiltrated, and the endothelium involved. Projections of the cancerous cells extend into the lumen and tend to ulcerate, often causing hemorrhages into the nodule. The biliary canaliculi are similarly attacked. The portal vessels and biliary ducts play a considerable part in the transportation and dissemination of the cancer cells.

Primary carcinoma of the liver is rare, forming about one-eighth of the cases. It occurs in several forms. It may be nodular similar to the secondary type; massive, or diffuse, the so-called "adenoma with cirrhosis."

Pathology. The massive type, in which the solitary tumor occupies a large area, is most common. It may completely involve a lobe or the greater part of it. The surface of the liver is not nodular and deformed as in secondary cancer, but

the hypertrophy is very great and the organ may weigh fifteen to twenty pounds.

On section, the liver is transformed into a soft or lardaceous mass. The surface of the section is grayish or yellowish, and the center of the cancer is hardly ever softened, while softening is frequent in the nodules of the secondary carcinoma. In some cases a few nodules are found around the main growth. The extrahepatic bile ducts and the large arterial and venous trunks are healthy. Perihepatitis, which is frequent in secondary cancer with its nodules, is rare in massive cancer.

Cancerous degeneration is found in the glands of the hilum, and in the gastro-hepatic, peripancreatic, prevertebral, and mediastinal glands. There may be metastases in the lungs or other organs.

In the type called adenoma with cirrhosis there is diffuse infiltration, with small growths and much hyperplasia of connective tissue. Some writers believe that the cirrhosis precedes, others, that it follows adenomatous degeneration; and still others believe that the two processes are concomitant.

Symptoms. Secondary cancer of the liver may be latent and the signs of disease in the primary focus (stomach, intestines, rectum, etc.) may predominate and the disease advance so rapidly that the condition in the liver is not suspected, only being found at post mortem. In a second type of case the primary focus may be latent and not discovered until autopsy, and the metastatic growth in the liver may progress very rapidly and simulate the primary lesion.

In many cases the onset is insidious. There is a period of general ill-health with languor, anemia, and weakness. Later there may be a sense of weight and discomfort, and in some cases local pain in the right hypochondrium. The pain element is variable. In some cases it is very severe and in others may be absent during practically the entire course of the disease. Digestive disturbances usually mark the onset. Dryness of the mouth, loss of appetite, anorexia, meteorism and fetid stools may be the earliest symptoms. Jaundice occurs in over fifty per cent. of the cases. It varies from a light tint to a deep coloration and is very often of a per-

manent type and tends to get deeper. It is due to compression and catarrh of the bile ducts.

Ascites is frequent but not as common as jaundice. In one-third of the cases both are present. The fluid is moderate in amount, stationary, and rarely requires tapping. It is pale, of low specific gravity, and often contains a small amount of albumin. It may be bile-stained, chyliform, or hemorrhagic. The ascites may be caused by cancerous masses obstructing the large trunks of the portal vein, partial peritonitis near the liver, or invasion of the peritoneum and omentum by the growth. The liver is enlarged in four-fifths of the cases. The enlargement is progressive and changes are detected from week to week. The edge is found below the "false ribs," and often at the umbilicus or lower. The edge, instead of being smooth and thin, grows soft and irregular. The upper surface is hard, uneven and nodular. When softening of the nodule takes place umbilication may occasionally be detected through the abdominal wall. The spleen is not enlarged and is a valuable negative sign. Audible and palpable friction may be present, indicating perihepatitis.

As the disease progresses the general symptoms become more marked. Emaciation, anemia, loss of strength, and peripheral edema, are commonly found. Cerebral and toxic symptoms, described under jaundice and cholemia, may supervene.

The symptoms of primary cancer do not differ greatly from those of the secondary type. For some time there may be no subjective symptoms or there may be a sense of weight, discomfort or pain in the right hypochondrium, often with anorexia and nausea. Later the digestive disturbances become more marked, with nausea, vomiting, and often with diarrhea. Ascites, dilatation of the subcutaneous abdominal veins, and jaundice, are almost always absent. There is usually acholia or hypocholia. The stools are colorless, or almost so, and very offensive. An important sign is the absence of jaundice associated with the acholia indicating a true hyposecretion of bile as well as obstruction. In most instances it is due to the widespread destruction of liver cells, although this condition is not limited entirely to cancer. One of the

chief signs is massive hypertrophy of the liver, which is smooth and hard, with a sharp edge. The urine is scanty, never contains albumin, is poor in urea, and rarely contains bile or bile pigment.

Cachectic edema, obliterating phlebitis, and diarrhea, are observed in all forms of cancer. Pyrexia is present in many cases. It may be remittent or intermittent but is usually continuous, ranging from 100° to 102° F.

The disease is fatal. Acute, rapidly progressing cases usually live only two or three months. The more chronic types may continue for fifteen to twenty months, but average from eight to ten months.

The *diagnosis* depends on rapid enlargement of the liver in a person of middle life or later, associated with jaundice and the development of cachexia. Tumors in other organs often are thought to be in the liver. When it is certain that a neoplasm is present in the liver, the chances are strongly in favor of carcinoma, and forty to one that it is secondary. In many cases it must be differentiated from cirrhosis, abscess, lues, or echinococcus cyst. It may be difficult to differentiate it at times from portal cirrhosis but the history, absence of bosses, signs of portal obstruction, and less marked cachexia, help to differentiate it.

The occurrence of the disease in youth, early jaundice, smooth surface of the liver, splenomegaly, and chronic course, distinguish it from biliary cirrhosis.

In abscess of the liver there is usually a history of gastrointestinal infection and ulceration; absence of cachexia, jaundice, and ascites; while fever and leucocytosis are more marked. Lues hepatitis is more painful, and a specific history, positive Wassermann, and positive therapeutic test, generally make the diagnosis easy. Hydatid disease usually presents a smooth tumor, thrill, enlarged spleen, positive complement fixation test, and chronic course.

Treatment. The treatment is purely palliative and symptomatic. Massive x-ray therapy may arrest the disease for a time and afford some relief.

Other Growths.

Sarcoma of the liver is comparatively rare. It may be primary or secondary, usually the latter. The most common are lympho-sarcoma and myxo-sarcoma; less frequently we find glio-sarcoma, or the smooth or striped myoma.

Melano-sarcoma is usually secondary to sarcoma of the skin or eye. Much more rarely it is primary. The liver is greatly enlarged and may be diffusely infiltrated. Metastases in other organs are common and often very extensive. Nodules in the skin, melanuria (a very dark urine when voided or turns dark on standing), melano-sarcoma, or blindness of one eye, may give a clue to the diagnosis.

Adenoma, cystadenoma, hypernephroma, from aberrant adrenal and other forms of hepatic tumor, may be met with occasionally.

ECHINOCOCCUS OF THE LIVER.

Echinococcus cysts of the liver are caused by infection with the larval form of *Echinococcus granulosus*, a small tapeworm in dogs.

Pathology. The adult of echinococcus is a minute tapeworm found in dogs and sometimes in other carnivorous animals. It measures only from one-tenth to one-fifth of an inch in length. The mature worm consists of a tiny scolex with four suckers and a double crown of hooks, followed by an unsegmented neck and three proglottides of gradually increasing size, the ultimate one of which is larger than all the rest of the worm and contains about five hundred eggs in the uterus. The eggs of the worm are discharged in the feces of infected dogs, which contaminate fields and pastures and frequently develop in sheep, cattle, and other herbivorous animals.

It may be transmitted to man by food and drinking water. Human infection usually results from too intimate association with dogs; children, especially, are liable to infection by allowing dogs to "kiss" them or lick their faces with a tongue which, in view of the unclean habits of dogs, may be an efficient means of transmission for the tapeworm eggs.

The egg when introduced into the digestive tract has a very thick wall which softens, setting free the embryo. The embryo, provided with sharp spicules, perforates the tissues and is probably carried by the blood of the portal vein to the liver, in which it is usually arrested. It loses its hooklets and secretes from its posterior portion an envelope in which it becomes encysted.

The wall of the cyst is composed of one internal layer which is but the transformation of the embryo (germinative membrane), and an external layer which is the product of secretion. A clear and transparent liquid accumulates in the cavity. The host produces another layer, a connective fibroid membrane due to the irritation of the hepatic cells. The development of the embryos is very slow. At the end of one month the cyst measures about one-twentyfifth of an inch in diameter. By the end of the fifth month it has grown to the size of a walnut.

About this time secondary, or "daughter," cysts develop from the inner surface, and on the inner surface of these secondary cysts in turn there grow a number of little heads or scolices. The daughter cysts may produce more cysts of like structure, to the third or fourth generation. Each of the heads has the power to grow into an adult worm. Sometimes instead of forming the usual large vesicles and secondary vesicles the growth results in the formation of a great mass of small separate vesicles, varying in size from a pin-head to a pea, with few and scattered heads. These are known as "multilocular" cysts. Often there is hypertrophy of the liver due to compensatory hyperplasia.

This disease is common in Iceland, where thirty to one hundred per cent. of the dogs are infected and are fed the uncooked entrails of infected animals. In Australia and in the southeastern part of the United States it is fairly common.

The precautions which should be taken to prevent the spread and to bring about the control of this disease may be summarized as follows: (1) Avoidance of too great familiarity with dogs; (2) exclusion of dogs from shores of lakes or reservoirs from which drinking water is taken; (3) extreme cleanliness in handling food; (4) prevention of

dogs from eating the entrails or meat scraps of animals which have been infected with hydatids.

Symptoms. During the early growth of the cyst there are usually no symptoms and sometimes the first symptoms are a feeling of weight in the right hypochondrium, or other pressure signs, after it has acquired considerable size. As in other diseases of the liver, there may be pain in the right shoulder, and a distaste for fatty foods. Occasionally secondary pleurisy develops, especially when the cyst is on the superior surface. Urticaria (before aspiration) has been reported.

The tumor may be palpable and is usually smooth, uniform and resistant which sometimes gives the sense of fluctuation. A hydatid thrill may be present, which is thought to be due to elasticity of the walls or fluctuation, and collision of the daughter cysts. Ascites and jaundice are rare unless there is compression of the portal vein and bile ducts. There is usually an eosinophilia, but the leucocyte count and percentage of polynuclears is generally normal. The cyst may grow several years without symptoms but usually after a time digestive disturbances become prominent, the appetite is lost, digestion is painful, loss of flesh is marked, and there are attacks of hemorrhage, epistaxis, or metrorrhagia. Some patients experience pain the abdomen, loins, or thorax. Dyspnea may be marked if the cyst pushes upward and interferes with respiration.

Often the cyst suppurates and the symptoms of liver abscess intervene. In other cases it may rupture into the intestinal tract, peritoneum, vena cava, biliary tract, pericardium, or through the abdominal wall, but most frequently into the right pleura or lung, causing purulent pleuritis. A few cases apparently cure spontaneously and are only discovered at post mortem.

A smooth, painless, resistant bulging in the liver, which develops slowly, without fever, jaundice or ascites, with eosinophilia, occurring in a locality where the disease is prevalent, can only be a hydatid cyst. However, it must often be differentiated from cyst of the spleen, ovary, or kidney, when it is pedunculated. When ascites or jaundice are present it may be mistaken for cirrhosis. Secondary cancer of the liver

is distinguished by its rapid growth, cachexia, or indurated bosses of the tumor. The diagnosis between pleural effusion and a cyst on the convex surface is often very difficult. The x-ray may be of aid in this connection.

Treatment. The treatment is entirely surgical. Formerly aspiration was largely practiced but now the operation of choice is laparotomy, with free incision and drainage or enucleation when this is possible.

Echinococcus multilocularis is more rare than the unilocular type and is rarely diagnosed, being usually mistaken for carcinoma or hypertrophic cirrhosis.

The mass in the liver feels firm and nodular, and is tender to pressure. Hydatid thrill and fluctuation are absent, and jaundice and ascites are usually present. There is rapid emaciation, loss of strength, cachexia, edema, cholemic symptoms, digestive disturbances—often with diarrhea. The disease may last several years but is usually fatal, and the course may be rapid.

EPIDEMIC CATARRHAL JAUNDICE.

Epidemic or infectious jaundice (Weil's disease; Spirochetosis Icterohemorrhagiæ) is a form of acute catarrhal jaundice, occurring in small or large epidemics. It is now believed to be due to infection by *Spirocheta ictero-hemorrhagiæ*.

The disease is obviously infectious and probably follows the ingestion of contaminated food and water. It occurs in epidemics in barracks, on ships, and under other conditions, which tend to show its infectious nature. Occasionally the epidemic becomes more extensive and involves towns, cities, or even larger areas. This condition was prevalent at several points on the front during the World War. French writers report that they had many cases under observation at all times, often as many as one hundred at a time at some bases.

Pathology. Many writers, particularly the French, have confirmed the observations of Inada and Ido, that the disease is due to an infection by *Spirocheta ictero-hemorrhagiæ*. The spirochetes are found in the liver, spleen, and other organs. They occur in the body fluids during the early stages of

the disease, remaining virulent for about one week. The blood is virulent for the first eight days but rarely after the second day of jaundice. The spirochetes are very sensitive to the action of bile salts, and the infection decreases rapidly as the jaundice increases. About the time that these organisms leave the blood-stream they may be found in the urine in increasing numbers, usually from the eighth to the fifteenth day, and they may be present from one to several weeks. However, their presence is not constant, and they may be found on one day and not the next. In districts in which the disease is prevalent, rats are found to be infected, often a large proportion of them, especially in the vicinity of slaughter houses. Since the organisms are present in large numbers in the excretions and secretions, especially the urine, the epidemiology of this disease is no doubt similar to that of typhoid fever and other infections of the gastrointestinal tract, and may be summed up as being closely linked to "Food, fingers, and rats." It has been found that the organisms penetrate the skin with ease (nearly one hundred per cent. when it is abraded or traumatized, and about fifty per cent. through normal skin). Several bacilli have been described as causative agents, but these are no doubt secondary invaders.

The *Spirocheta icterohemorrhagiae* closely resembles *Spirocheta pallida* and other members of this group of organisms. It has numerous distinct spiral turns and is provided with terminal cilia. It invades all the tissues of the body and may be found in the liver, spleen, kidneys, lungs, and other organs, and in the blood, spinal fluid, and urine. It stimulates the production of specific protective antibodies in the blood, and after the tenth day the agglutination test is positive in the majority of cases.

The liver is jaundiced and somewhat enlarged. On section it is firm and free from fatty change. The histological changes vary from practically no change in the cases fatal early in the disease, to a widespread and marked necrosis in those cases of long standing. Early in the disease there is a slight amount of necrosis of the liver cells and an occasional mitotic figure is seen. Later the necrosis is more marked, mitotic figures are plentiful, and the liver cells are

dissociated, with loss of cement substance. A notable feature in this condition is the marked tendency to regeneration, even in the most severe cases. Hemorrhages are numerous and often extensive. The lungs are the most frequent site, but they may also occur into the suprarenals, spleen, kidneys, and beneath the mucosa of the intestinal tract. The kidneys are usually involved in the disease. There is marked necrosis of the cells of the convoluted tubules, which frequently contain casts. The spirochete can often be demonstrated in these casts, and many of them lose their corkscrew character and appear as straight rods. The biliary passages are rarely blocked and the jaundice is due to hepatitis, pericholangitis, cholangitis, and there is some evidence that it may also be due to poor function of the liver cells.

The disease attacks principally young male adults and men who work and live under unsanitary conditions. It occurs most frequently during the summer months. It is not uncommon in the United States; numerous small epidemics and a few larger ones have occurred, principally in the southern states.

Symptoms. After an incubation period of about one week the onset is sudden, often with a chill. After a few days there is severe prostration with malaise, pains in the limbs and back, headache, giddiness, and loss of appetite. Gastro-intestinal symptoms are common. Often there is nausea, vomiting, and derangement of digestion. Diarrhea is present in many of the cases. On about the third or fourth day the jaundice appears and it may be slight or very intense. The spleen and liver are usually enlarged, with marked tenderness over the latter. The urine contains albumin and casts, and other signs of nephritis are present. In the severe forms there are nervous symptoms and hemorrhages. Anemia is usually marked and there is an initial leucocytosis with an increase in the polymorphonuclear cells. Eosinophilia is constant and the coagulation time of the blood is increased. In the second week the fever falls by staircase descent and the symptoms gradually clear up. There is a marked tendency to a relapse of the fever after a remission of a week, but the prostration is not so marked.

The *prognosis* is good. Most cases recover spontaneously in two or three weeks. About four per cent. of the cases are fatal, most of them with symptoms of cholemia. In many cases the convalescence is slow and protracted.

The *diagnosis* can be made before the appearance of jaundice by inoculating a guinea-pig (which is very susceptible) with blood, spinal fluid, or urine. A characteristic reaction takes place in the pig, consisting of numerous hemorrhages in the viscera and necrosis of the liver. The spirochetes can be demonstrated in the organs of the pig. After the tenth day the agglutination test becomes positive and the spirochetes can in many cases be found in the urine by centrifugalization.

Treatment. The general treatment is symptomatic and similar to that of acute catarrhal jaundice, which it closely resembles. The diet should be light and sustaining, avoiding fats and oils, and the patient should be at rest in bed during the acute stage. As the gastric symptoms and jaundice decrease in severity the diet may gradually be augmented by lean meat, bread, vegetables, gelatin, custard, etc. Frequent small meals during the day aid in decreasing the amount of bile secreted. Hexamethylenamin and salicylates may be given to help sterilize the biliary tract, and the latter also act as an anodyne for the pain. Later, saline aperients are useful in draining the biliary system. Immune serum has been of value in treating the disease in a few reported cases.

The prophylactic care of these patients is similar to that of typhoid fever and other infectious intestinal diseases. The patients should be isolated; have their own dishes, which are boiled after using; have their own bed and personal linen, which is boiled or treated with germicides. The feces and urine should be sterilized or disinfected, and the usual so-called "typhoid precautions" taken. There seems to be some evidence that the disease is also transmitted through the respiratory secretions, and suitable precautions should be taken accordingly.

ACUTE CATARRHAL CHOLANGITIS.

Acute catarrhal cholangitis, or catarrhal jaundice, is a condition characterized by jaundice, gastrointestinal disturb-

ances, and symptoms of cholemia. It is found chiefly in young adults, and more commonly in men than in women.

Pathology. This condition is obstructive (of the duct) in nature. Following indiscretions in eating or drinking, or exposure to cold causing a gastroduodenitis, the inflammation extends to and involves the papilla of Vater and the lower part of the common duct. The mucosa becomes swollen, hyperemic, and edematous, and the inflammation extends into the surrounding lymphoid tissue. In some cases the lumen of the intraduodenal part of the common duct is obliterated, and often a plug of mucus and epithelium is found obstructing it. Above this point a catarrhal condition exists which may even involve the smaller intrahepatic ducts. The liver may become swollen and occasionally the gall-bladder is distended. It also occurs during the course of the acute infectious diseases, in which cases it is thought that the infection may be hematogenous in origin and be of a descending type. In other cases it is thought to be due to the ingestion of ptomains or other toxic substances. Some cases have been reported following strong emotional disturbances, such as fright, grief, etc., when the jaundice appears in a very short period of time, sometimes in a few hours. It also occasionally occurs during the course of portal obstruction, chronic heart disease, and Bright's disease.

Symptoms. The symptoms of onset are those of gastro-duodenitis. There is epigastric pain or distress, flatulence, nausea, sometimes with vomiting and diarrhea. After a few days the jaundice begins to develop insidiously, gradually, and progressively becomes more intense involving the conjunctivæ, mucous membranes, and skin. It may be a deep yellow, but rarely assumes the dark-brown or green hue. Usually there is constipation, with fetid clay-colored stools. The urine is dark brown or black and foams easily which is colored yellow. It also gives a positive reaction to Gmelin's nitric acid test. A small amount of albumin and a few casts are commonly present. The liver may be slightly enlarged and tender. The pulse and respirations are often slow and other signs of cholemia may develop. Usually there is more or less depression and in some cases melancholia. Headache, vertigo, malaise, insomnia, weakness, and asthenia, are com-

monly present. The temperature may be increased and there may be drowsiness or stupor simulating the so-called "typhoid state." Occasionally a case presents itself without a history of exposure, gastrointestinal disturbances, or other apparent etiological factor, the chief and sometimes only symptom being the deep, progressive jaundice.

The disease is rarely fatal. The symptoms begin to subside in from two to four weeks and the jaundice gradually disappears, the urine becomes lighter, and bile is again observed in the stools. In some cases the symptoms persist longer and it may last six to eight weeks, but rarely longer. When it does, acute yellow atrophy, cancer, gall-stones, or chronic pancreatitis, should be suspected.

Simple catarrhal jaundice is distinguished from impaction of a gall-stone by the history, the pains occur earlier and are more severe and colicky in stones, and fever, chills and sweats; from Weil's disease by acute onset, fever, and splenic enlargement; from acute yellow atrophy by the failure to clear up, grave cholemic symptoms, rapid diminution in size of the liver, and presence of amino-acids in the urine; from carcinoma by age, duration beyond six weeks, emaciation, and cachexia.

Treatment. The treatment is essentially that of the gastroduodenitis. The patient should be kept in bed and food withheld during the acute period; the appetite is a fairly good criterion to be guided by. Cream, fats, oil, and meat should not be given until convalescence is well established, and then added slowly and cautiously. At first the diet should consist only of skimmed milk, broths, and large amounts of liquids in other forms, such as Vichy or other alkaline waters, plain water, or water to which has been added soda bicarbonate. Nausea and vomiting, if persistent, may be controlled by alkalies, bismuth subcarbonate, cerium oxalate, carbolic acid, dilute hydrocyanic acid, lavage, and hot applications to the epigastrium. The bowels should be kept open. Saline cathartics are the best for this purpose, or calomel may be given, followed by a saline. Sufficient quantity should be given to ensure two or three free movements a day.

As the appetite returns, the coated tongue clears up, and bile is again observed in the stools, additions may be made

to the diet. Purées, soups, dry toast, custard, and easily assimilable foods should be given first. Later, as improvement continues, meat, fish, cream, etc., may be cautiously added.

The weakness and debility often require the use of general or bitter tonics, fresh air, moderate exercise, and other hygienic measures.

CHRONIC CATARRHAL CHOLANGITIS.

Chronic catarrh of the biliary passages is due to a low grade infection. It may follow the acute catarrhal form or be a type of it, more insidious in onset and chronic in its manifestations. It is also commonly found associated with gall-stones, cholecystitis, chronic infections of the intestine, and gastroduodenal catarrh. In other cases it occurs with chronic obstruction of the ducts, chronic disorders of the liver, chronic abscesses, and after various infectious diseases.

Pathology. The process commonly involves the extrahepatic ducts. It may affect only the larger ducts, or it may also affect the finer intrahepatic ducts. There is a chronic hyperemia, thickening of the walls of the biliary passages with partial obstruction of the lumen and often dilatation. Pericholangitis is usually present. The production of mucus is increased and the character of the bile changes. In some cases it may be colorless. When the obstruction is complete the ducts and gall-bladder become greatly dilated, and even the intrahepatic bile passages may be distended. The mucus is often sterile, and in these cases the walls of the ducts are smooth. In other cases they may show ulcerations.

Symptoms. The symptoms are those of acute catarrhal jaundice, usually less severe but prolonged. The attacks of jaundice are intermittent and vary in intensity. Usually when the contents of the ducts are sterile there is no fever. When the duct is incompletely obstructed the remissions in jaundice are more marked. There often are recurring attacks of fever, chills and sweats; intermittent hepatic fever. The stools may show varying grades of decoloration during the attacks, depending upon the amount of obstruction present.

The symptoms may be, in many cases, much less severe than described above. Jaundice may be absent, or only a slight subicteric hue or coloration may be present. The

symptoms may be principally gastric, with recurring attacks of indigestion and "bilious attacks." This condition not infrequently persists following cholecystectomy (about ten per cent.) in those cases which do well for a short time but after a few weeks or months complain of recurring attacks of indigestion, flatulence, belching, loss of appetite, possibly chilly sensations, without jaundice, etc. Lyon's method of non-surgical drainage, by means of the duodenal tube and stimulation of bile flow with magnesium sulphate, is of considerable value in making the diagnosis in these cases. Very often strings of mucus and mucopurulent flakes, free pus cells, and columnar epithelium which may be identified with that of the ducts, are frequently found, particularly in the "C" fraction or the bile obtained later during the aspiration. Many of these cases do very well under medical treatment.

Treatment. The patient should be on a light sustaining diet in the more severe cases but it may be more liberal in the milder types. Fats and oil should be avoided. Large amounts of liquids, especially alkaline waters, should be given, and any other measures which will stimulate the flow of bile, instituted. Bile salts or ox-gall is sometimes helpful. The non-surgical drainage advocated by Lyon has been of help in many cases. The drainage may be performed daily at first, and as the symptoms and character of bile (microscopically) improves and the quantity increases, the interval may gradually be extended to every other day, every third day, etc. The drainage treatments should be continued for several weeks. In cases where it is impractical to use the duodenal tube or circumstances do not permit its use, small repeated doses of calomel and the daily use of magnesium sulphate by mouth often produce the desired results. Especial attention should be also given to the general condition of the patient. Tonics, fresh air, exercise, and sufficient rest, are necessary adjuncts.

In protracted cases not benefited by non-surgical drainage and in which definite obstructive pathology exists, such as an impacted stone, surgical interference and drainage are required.

ACUTE SUPPURATIVE CHOLANGITIS.

Suppurative cholangitis is an extensive purulent inflammation of the bile ducts and passages.

The disease is directly due to infection by pyogenic organisms, but generally follows many local conditions and general diseases which act as predisposing causes. The organisms most frequently found are: *Bacillus coli*, *Bacillus typhosus*, *Streptococcus pyogenes*, *Staphylococcus aureus*, and *Pneumococcus*. The organisms most commonly reach the biliary ducts by way of the portal vein and general circulation, producing the descending type of infection. In cases preceded by gastroduodenitis, typhoid and other inflammatory conditions of the gastrointestinal tract, the infection may be ascending by direct extension from the lower part of the common duct.

In the majority of cases there is local disease of the biliary tract. Any condition which prevents the free drainage of bile or tends to obstruct the duct, producing stasis, is an important factor in bringing about this condition. Gall-stones and suppurative cholecystitis very often precede suppurative cholangitis. The obstruction may be caused by a stone impacted in the common duct, tumors, adhesions, kinks, swollen glands, etc, which may cause complete, partial, or intermittent obstruction. Gall-stones themselves are a consequence of low-grade biliary infection and catarrh, and by the obstruction of the flow of bile that they induce, as well as the trauma and consequent reduction in the resistance of the biliary mucosa, they participate in the formation of a vicious circle. Occasionally it follows the acute catarrhal form.

Pathology. The ducts may be very much dilated and are filled with bile and purulent material. The walls are swollen and soft. The mucosa is edematous, congested, and covered with a layer of muco-pus. In advanced cases it may show ulcerations. The liver is often enlarged, soft, and the surface irregular. About the terminal branches of the ducts are numerous abscesses, which are usually very small but occasionally are found to be of considerable size. Microscopically are found the usual lesions of suppurative inflammation, in-

cluding congestion, edema, cellular infiltration, necrosis, desquamation, etc. The gall-bladder is often found filled with pus, and with extensive adhesions to adjacent viscera.

Symptoms. The onset may be insidious or may be preceded by a history of symptoms which suggest cholelithiasis, cholecystitis, or acute catarrhal cholangitis; or there may be gastrointestinal disturbances. In most cases, during the course of one of the preceding conditions, jaundice develops which usually is not deep unless there is marked obstruction of the duct. Accompanying the jaundice are fever, chills and sweats with remissions. The fever is of the septic type and the exacerbations are accompanied by a marked polynuclear leucocytosis. The liver is usually enlarged, soft and tender, and if cholecystitis exists the gall-bladder is enlarged and tender. Pain is variable. It may be acute or there may be only a sense of weight and distress in the right hypochondrium. The patient rapidly becomes weaker, with progressive emaciation.

Peritonitis, subphrenic abscess, and single or multiple liver abscesses may develop by direct extension. Septicopyemia, endocarditis, and lung abscesses, result in some cases from infection of the hepatic vein. In other cases fistulous communications with the duodenum, colon, pleura, or lung, may be formed.

Fever, chills, sweats, with a leucocytosis, jaundice, pain, and enlargement of the liver and spleen, point to purulent cholangitis. In some cases it may be difficult to distinguish between this condition and liver abscess or pylephlebitis. Jaundice usually develops earlier in suppurative cholangitis.

Unless spontaneous evacuation of the pus takes place, or surgical drainage is instituted, the prognosis is serious. The disease seldom runs more than three or four weeks.

Treatment. The treatment is surgical. Free drainage and evacuation of the pus is essential. Hexamethylenamin, by mouth or intravenously, salicylates and other drugs to disinfect the biliary tract, may be of considerable help. Impacted stones, gall-bladder stones, and an inflamed gall-bladder and adhesions, etc., should be carefully looked for and removed during the course of the operation when present.

The surgical removal of those conditions which act as predisposing causes, such as infected gall-bladders; the careful medical treatment of acute catarrhal cholangitis, chronic cholangitis, acute gastrointestinal conditions, etc., can do much to prevent the occurrence of suppurative cholangitis.

ACUTE CHOLECYSTITIS.

Acute inflammation of the gall-bladder is an affection usually due to infection, frequently associated with cholangitis and stones, the manifestations of which are extremely variable. Four types are commonly recognized: the acute catarrhal, the suppurative, the phlegmonous, and the gangrenous. The last is usually a late stage of, or associated with, the phlegmonous type. Although the above distinctions are often made, there is no hard and fast line separating the different types, and various degrees of pathology and symptomatology are found, ranging from the simple catarrhal form without symptoms, to the fulminating phlegmonous and gangrenous types. They are difficult to distinguish clinically.

Cholecystitis is, in practically all cases, due to infection of the gall-bladder with pyogenic organisms, the severity of the disease depending rather on the virulence than the variety. Those most commonly found are, *Bacillus coli*, *Bacillus typhosus*, *Bacillus typhi*, staphylococci, streptococci, pneumococci, Friedlander's bacillus, *Bacillus aerogenes capsulatus*, and others. In general the milder catarrhal forms seem to be associated with *Bacillus coli* and typhoid infections, and the suppurative type with the pyogenic cocci, but this rule is not fast and any of these organisms may produce any type of cholecystitis. In some cases there is a mixed infection, and in others a secondary invader may outgrow the original organism. The latter condition is thought to occur frequently following typhoid infections.

Experimentally it has been shown that injections of toxins may produce the lesions. A few cases in which the gall-bladder contents were sterile are thought to be of this type, but they also may originally have been infectious in nature.

It is now well known that the gall-bladder is almost constantly infected during typhoid fever. This is without doubt

one of the principal factors in the production of cholecystitis, as shown by the large proportion of cases of cholecystitis and cholelithiasis in which a history of a previous attack of typhoid fever is obtainable. In another group of cases an attack of cholecystitis may occur during the course of typhoid fever, while in a third group of typhoid infections the infection of the gall-bladder appears to be primary without the symptoms of typhoid fever, and the only distinguishing feature from the cases due to other organisms is the presence of a positive Widal reaction.

The source of infection is no doubt most frequently via the portal vein. From the liver the infection may reach the gall-bladder through a descending cholangitis or through a rich chain of lymphatics directly connecting the liver and gall-bladder, as shown by Graham. In this connection focal infections of the abdominal viscera play an important part. This is well illustrated by the frequency with which cholecystitis and cholelithiasis are found associated with appendicitis, as pointed out by Dieulafoy. Occasionally the order is reversed and the gall-bladder condition precedes the appendicitis.

Cholecystitis is very frequently associated with cholangitis. Besides the descending type of infection mentioned above, it may be ascending, secondary to gastroduodenitis, enteritis, or acute catarrhal jaundice.

In typhoid, influenza, pneumonia, and other infectious diseases, including sepsis and pyemia, the blood stream may carry the organisms directly, but this mode of infection is much more rare than that described above. In a few rare cases the infection may take place directly through the peritoneum from inflammation in some contiguous organ, such as gastric or duodenal ulcer, liver abscess, etc.

The predisposing causes of cholecystitis are numerous, and similar to those of gall-stone formation. After a patient has had one attack the infection may remain latent, and under sufficient provocation succeeding attacks occur, although a long period of time may intervene; or it may occur as an exacerbation of a chronic cholecystitis. In this connection may also again be mentioned previous typhoid infection and typhoid carriers who harbor the typhoid bacilli which remain

latent in the gall-bladder and are periodically discharged with the bile, although the carrier does not have symptoms. Gall-stones are frequently found associated with cholecystitis and tend by irritation to produce ulceration or trauma to the mucosa, which favors infection. Parasites and ova have also been found in the gall-bladder and cystic duct. There are many factors which tend to produce biliary stasis and cholangitis, and are important on this account. Among these may be mentioned sedentary habits, constipation, obesity, abdominal tumors, pregnancy, tight lacing, and* other conditions which interfere with the descent of the diaphragm. (See Cholelithiasis.)

ACUTE CATARRHAL CHOLECYSTITIS.

This is frequently associated with gall-stone formation, and may precede, follow, or be concomitant with, the formation of the stones. A dependent fundus may cause poor drainage and with the irritation of stones set up an acute attack. In other cases chronic constipation and accumulation of feces in the hepatic flexure, interfering with functional activity of the gall-bladder, are prominent predisposing causes. It also often occurs during or following cholangitis, acute catarrhal jaundice, etc.

Pathology. Stones may or may not be present. Occasionally it follows the passage of a stone. Usually the gall-bladder is distended and the walls tense, but it rarely forms a distinct tumor. It is filled with thick, tenacious, ropy mucus, which is sometimes mixed with bile. Occasionally the contents of the gall-bladder are serous or sero-fibrinous. The walls are swollen, edematous, and the mucous membrane is congested and covered with mucus. Ulceration may occur but usually the process is not severe enough to produce actual ulceration. Unless gall-stones have been present, usually there are no adhesions. The serous coat may be congested, dull, and adherent to adjacent parts by fibrin. Microscopically the villousities of the mucous membrane are prominent. There is desquamation of epithelial cells and the cells contain myelin granules. The vessels are engorged, the mucous glands are inflamed and the fibro-muscular layers are swollen and may show small-celled infiltration.

Symptoms. The symptoms are variable. In many cases there are no subjective symptoms and in others they may be mild and referred to the gastrointestinal tract and diagnosed as dyspepsia, etc. In a typical attack usually there is pain in the right hypochondriac region. It varies in intensity and character, and may be paroxysmal simulating gall-stone colic but is less excruciating, as a rule. The region over the gall-bladder is tender, with rigidity of the muscles, and often there is local cutaneous hyperesthesia. Jaundice is rare. The enlarged gall-bladder may in some cases be palpated as a mass moving with respiration.

The distention of the gall-bladder is due to inflammatory exudation blocked by swelling of the mucosa of the cystic duct. As the inflammation subsides the fluid is discharged through the duct and the swelling and tension disappear.

Complications are not very common, although appendicitis (Dieulafoy), endocarditis, and obstruction due to local peritonitis (Robson), are occasionally met with. This type of obstruction usually disappears without interference.

The *diagnosis* is usually easy in typical cases. It may be distinguished from gall-stone colic by paroxysms which are not so severe nor long, absence of stones in evacuations, and jaundice is rare; from suppurative cholecystitis by a milder course, but there is no fast rule; from appendicitis by palpation of a rounded tumor, with the convexity pointing down from the hypochondrium in the case of cholecystitis and the convexity pointing upward in the case of appendicitis. The previous history may also help to differentiate them.

The *prognosis* is good. It tends to subside rapidly in the milder cases. Stone formation at some later period is very common. If the cystic duct becomes occluded by inflammation or a stone, hydrops or serous distention is likely to result. In other cases the acute attack may continue into chronic cholecystitis or chronic simple empyema and adhesion formation.

Treatment. During the acute attack the patient should be in bed and have an easily digestible diet. For gastric symptoms, bismuth, dilute hydrocyanic acid, and alkalies are useful. Salicylic acid and hexamethylenamin may be tried in an effort to disinfect the biliary tract. For pain, acetyl

salicylic acid in 10-grain doses may be sufficient. It may be repeated in an hour, if necessary. In some cases morphin may be required. The local application of heat is of considerable help in many cases. The judicious use of saline aperients is of distinct benefit, and Lyon's method of drainage may be helpful.

Later the patient should have regular exercise, massage over the liver, and the diet should be carefully supervised and regulated. Sedentary habits, constipation, etc., should be corrected, and tight clothing avoided.

SUPPURATIVE CHOLECYSTITIS.

This form is, as a rule, associated with gall-stones. It may be a sequel to the catarrhal form and may be found in obstruction or compression of the ducts by tumors, adhesions, kinks, bands, etc. It also may follow or occur during the course of typhoid and other fevers.

Pathology. The gall-bladder is often enlarged, but may be small and shrivelled up. The peritoneal coat is inflamed, dull, granular from adherent lymph, and adhesions are frequently present. The wall of the gall-bladder is swollen, softened and friable. The mucous membrane is largely destroyed, and the free surface is red and shows granulation tissue. Frequently there is small-celled infiltration. Ulcerations near the fundus are common. The contents of the gall-bladder are bile-stained or sanious pus. Calculi are often present.

Symptoms. Frequently there is a history of a typical gall-stone seizure followed by swelling under the right lobe of the liver and by a continued instead of an intermittent pain. At first the constitutional symptoms may be slight, with little or no increase of temperature, though later it may become high. In some cases it is high from the beginning. There may be anorexia, fever, and general malaise at first, followed by more severe gastrointestinal symptoms, such as vomiting, nausea, loss of weight and flesh, and paralysis of the gut when peritonitis is present. Rigors, chills, and fever, point to the formation of pus. The pulse is usually high, sometimes one hundred to one hundred and twenty. An increasing pulse rate is an indication for immediate surgical inter-

ference. There is pain on movement, and tenderness in the right hypochondrium, with rigidity of the rectus muscle. Jaundice is very rare. There is usually a leucocytosis of 15,000 to 30,000. A tumor, moving with respiration, may sometimes be made out. In the presence of dense adhesions it may be fixed. The spleen may be enlarged and there may be toxic albuminuria.

Treatment. The treatment is surgical. Hot applications may be useful to help allay pain. Often morphin is necessary, but should not be used until the diagnosis is made and the proper treatment has been decided upon.

ACUTE PHLEGMONOUS CHOLECYSTITIS.

The phlegmonous form is a relatively rare condition and is analogous to acute appendicitis. It is usually associated with stones, and may follow typhoid and typhus fevers, cholera, malaria, sepsis, puerperal fever, and other unknown conditions.

Pathology. The pathology of the gall-bladder is similar to that of the suppurative form but more severe and extensive. The outside of the gall-bladder is purple, edematous, inflamed, and covered with adherent lymph. The walls are swollen, friable, and infiltrated with pus and blood. The mucous membrane is swollen, ulcerated, with areas of necrosis, or may be separated into flakes. A membranous cast is sometimes found. The gall-bladder contains pus, and often stones.

Symptoms. The symptoms are very acute, and the onset is sudden, with pain in the right side of the abdomen and marked tenderness on pressure. There is marked prostration, with rapid, feeble pulse, sweating, and intense depression. The temperature is usually increased. Soon nausea, vomiting, and rapidly developing tympanites, occur and the picture is then one of the so-called "acute abdomen." The peritonitis, which at first is local, soon becomes general. Jaundice may or may not be present.

The *prognosis* is grave. If very acute or gangrenous, death speedily occurs unless immediate surgical relief is received; but if subacute, an abscess may develop around the gall-

bladder and the peritonitis become localized, the disease then resembling a perityphlitic abscess in its course.

The *diagnosis* is often very difficult and it may be confused with perforated ulcer, acute obstruction, acute appendicitis, or acute pancreatitis, as the patient may present the symptoms of acute peritonitis which are common to all of them. The history of previous cholecystitis, gall-stones, and pain beginning in the region of the gall-bladder, may be of help. Exploratory laparotomy is indicated if doubt exists.

Treatment. The treatment is surgical and the operation should be performed immediately, or as soon as the patient's condition warrants.

Gangrene of the gall-bladder is an extreme condition of the phlegmonous type. It is supposed to follow (1) thrombosis of the nutrient vessels, (2) bacterial infection, (3) absence of drainage (inflammation and tension), stones in the cystic duct, (4) torsion (rare).

The same inflammatory phenomena are found as in the phlegmonous type, and in addition there is a variable amount of gangrene, which usually begins in the fundus and progresses toward the neck. The cystic duct is generally blocked and usually stones are present. The symptomatology is also that of a late stage of phlegmonous cholecystitis plus that of acute generalized peritonitis. The diagnosis is very difficult and usually is only made at operation. The treatment is early removal of the gall-bladder.

The *prophylactic treatment of cholecystitis* theoretically resolves itself, as in cholelithiasis, into the prevention of infection of the portal stream from focal infections of the abdomen, such as chronic appendicitis, ulcers, hemorrhoids, colitis, cecum mobile, toxemia, pelvic suppuration, etc. Careful examination of all patients for anal fissures, hemorrhoids, etc., will no doubt help to prevent some of these cases. The predisposing causes are also very important. The correction of constipation, toxemia, faulty habits of eating, drinking and elimination, poor hygiene, tight lacing, etc., and the substitution of plenty of exercise and fresh air, rational diet, and proper rest, may prevent recurrences in some cases and the first attack in others. The use of hexamethylenamin and

salicylates for a time after typhoid fever may be of some benefit.

CHRONIC CHOLECYSTITIS.

Chronic cholecystitis very often results from or is a sequel to an attack of acute cholecystitis. The infection may for a time be latent and later show the characteristic exacerbations. In other cases it may be chronic from the beginning. The etiology is the same as that of the acute form and cholelithiasis, and is due to infection by organisms of more or less attenuation and low virulence. The majority of the cases are associated with gall-stones and general catarrh of the biliary tract.

Pathology. In the milder catarrhal types there is erosion of the apices of the papillæ of the mucosa, the papillæ appearing as yellow specks, the "strawberry gall-bladder" of Macarty. In other cases the gall-bladder is somewhat distended and contains thick tenacious mucus, bile, or both. The mucosa is swollen, congested and desquamating, with increased formation of mucus. In many cases of long standing the mucosa and muscularis are atrophied, and the gall-bladder is very much shrunken and shrivelled, forming a part of a mass of adhesions. The walls are thickened in other cases and the inner surface thrown into folds. Microscopically the thickening of the wall is due to fibrosis and proliferation of the connective tissue between the muscular and serous coats. Cholesterin deposits and calcareous infiltration are common. When the gall-bladder is distended from a stone lodged in the cystic duct, the walls are smooth and thin. The cystic duct is usually at least partially patent and in some cases entirely so. Stones may or may not be present.

Symptoms. The symptoms are essentially those of cholelithiasis, from which it is distinguished with difficulty. There are repeated attacks of biliary colic from time to time. In the intervals when the subacute attack of inflammation has subsided there is no jaundice and no tenderness over the gall-bladder, which can sometimes be felt. The presence of a gall-bladder shadow on an x-ray film is, in practically all cases, evidence of a pathological condition and is valuable confirmatory evidence. In other cases there may be evidence of pyloric or duodenal adhesions and pylorospasm, which are

usually significant; sometimes the topography of adjacent viscera is suggestive.

The *diagnosis* of chronic cholecystitis from lithiasis is practically impossible in very many cases. The x-ray shows only forty to sixty per cent. of stones in positive cases. The presence of stones in the stools is presumptive evidence that there are more in the gall-bladder.

Treatment. The treatment is the same as that for cholelithiasis. The medical treatment is directed to the prevention of stagnation of bile, and to increase the flow of bile through the ducts by careful diet with plenty of water, hexamethylenamin and sodium salicylate, regular action of the bowels, and exercise. The diet with feast and fast days, outlined under the treatment for chronic interstitial pancreatitis, is suitable during an attack. The following prescriptions have also been found useful (Bassler):

(1) R

Oxgall	℥ss.
Salol	℥ij.
Ext. cascara sag.	gr. xv.
Hydrarg. chlor. mitis.	gr. ij.
Fiat pil. No. 50.	
Sig.: One tablet after meals.	

(2) R

No. 1. Make 24 pulv. āā	
Sod. glycocholate	gr. iv.
Sod. salicylate	gr. v.
Sod. bicarbonate	gr. v.
Pancreatine	gr. x.

No. 2. Glycerine	℥iss.
Comp. tr. cardamom	q. s. ad. ℥iij.

M. Sig.: Dissolve one powder in one-half tumbler of water, and when well mixed add a teaspoonful of the mixture from the bottle. Take this combination about 5 minutes after each meal.

Surgical treatment is indicated in cases having severe recurring attacks and cases not benefited by the medical treatment.

CHOLELITHIASIS.

Cholelithiasis or gall-stones, is a common condition, being found in five to ten per cent. of necropsies on persons dying from all causes. Over seventy-five per cent. of the cases occur after forty years of age, although the stones may have

formed in early adult life and remained latent. About three-fourths of the cases occur in women, and pregnancy seems to be a prominent predisposing factor, as most of them have borne children.

Etiology. The two outstanding factors necessary for the production of gall-stones are, a low-grade catarrhal inflammation of the bile ducts and gall-bladder, and biliary stasis. The infection of the ducts usually takes place through the portal system, and may be a descending cholangitis associated with cholecystitis; ascending cholangitis following gastroduodenitis; the gall-bladder may be infected by way of lymphatics from the liver, by which these two organs are closely associated; or more rarely through the general circulation by way of the hepatic artery.

There are many contributing or predisposing causes. Among those which mechanically tend to produce stasis may be included sedentary habits and obesity, which are often associated with weak abdominal muscles; shallow respiration, and more or less asthenia. Hepatoptosis, gastropptosis, enteroptosis, nephroptosis, and tight lacing, may cause varying degrees of stasis by producing kinks, twists or compression of the ducts, interfering with proper drainage.

Conditions producing and associated with gastrointestinal catarrh are potent factors, in that they directly or indirectly often are the cause of chronic catarrh of the ducts. Indiscretions in eating and drinking; alcoholism; constipation and toxemia, are important in this connection. When symptoms from stones already formed are referred to the stomach, manifested by dyspepsia, flatulence, eructations, etc., they tend to keep up a vicious circle by perpetuating the gastroduodenitis and cholangitis. Passive congestion of the liver from chronic cardiac or pulmonary disease and other causes of congestion, and hepatitis, may be important predisposing factors by producing biliary stasis.

Some writers think that metabolic derangements are concerned in their production, but there is much conflicting evidence on this point. Still others have associated the formation of gall-stones with a "diathesis"; some cases being found in persons who have had or are suffering from gout, rheuma-

tism, urinary lithiasis, migraine, asthma, diabetes, eczema, and obesity.

As before stated, a catarrhal condition and infection of the gall-bladder and bile ducts are thought to be necessary for the formation of the stones. The gall-bladder is a peculiarly favorable habitat for bacteria, and they may remain there for long periods of time, as witnessed by chronic carriers, many of whom probably escape detection. Many patients give a history of having had typhoid at some previous time, often fifteen or twenty years before. It is well known how frequently the gall-bladder is involved in this disease, and that the organ often remains infected for some time after the patient has clinically recovered from the acute attack. No doubt this associated cholecystitis is the starting point of the formation of the stones in the majority of these cases, although the growth may be very slow or latent. The original attack of cholecystitis may subside and many years later a gastrointestinal upset, or the other factors mentioned, may bring on another attack of cholangitis and cholecystitis, which gives the stones a new opportunity to increase in size and favors the formation of new ones. Other organisms frequently producing cholecystitis and associated conditions are, *Bacillus paratyphosus*, *Bacillus coli*, *Streptococci*, *Staphylococci* and *Pneumococci*.

Pregnancy is a very common predisposing factor, as three-fourths of the cases occur in women and, according to Naunyn, ninety per cent. of these women have borne children. The exact relationship of pregnancy to the formation of gall-stones is not very well understood. By some it is said to be due to mechanical biliary stasis, since pregnancy causes a relaxation of abdominal muscles, interferes with movements of the diaphragm, favors ptosis of viscera, etc. Pregnant women are less active, more sedentary, and constipation and toxemia are more common. In other words, these are the usual predisposing factors outlined above, probably accentuated. In addition there may be some effect due to metabolism, excretion, circulation, etc. Gall-stone colic not infrequently appears during pregnancy. It may occur during pregnancy, at term, or during the puerperium. Three varieties of colic associated with pregnancy have been de-

scribed. "First variety: A young girl who has never had hepatic colic, marries; during her first pregnancy hepatic colic appears, and reappears during subsequent pregnancies, but never apart from the puerperal condition. Second variety: A woman who has never had hepatic colic, either as a girl or later during pregnancy, is seized with hepatic colic some days or weeks after delivery. The colic recurs after subsequent deliveries and is never present except at this time. Third variety: Hepatic colic appears either during pregnancy or after labor, and again later, at indeterminate periods when the woman is not pregnant." (Dieulafoy.) Colic during pregnancy is not materially different from the usual type. The diagnosis is usually easy, but before delivery miscarriage, and during the puerperium, peritonitis may be suspected. The immediate prognosis is usually good. Repeated attacks during pregnancy may occur without influencing its course or producing abortion.

Pelvic infection may also be the source of infection of the gall-bladder and the indirect cause of gall-stones. Appendicitis is frequently associated with stone formation. In most cases the appendix is primary; the stones often being "silent" or their symptoms masked by the pelvic condition. In other cases the appendix may be secondary to the stones but this condition, no doubt, is rare. Other causes which may precede stone formation are puerperal infection, ulceration of the colon and rectum, hemorrhoids, suppurative colitis, etc.

Pathology. The size and number of the stones vary considerably; the more stones, the smaller the size. There may be one large stone, which is usually oval or rounded and may be large enough to occupy the entire gall-bladder. The smaller stones may be very numerous, sometimes more than one thousand. They are usually smooth and faceted where adjoining stones lie in apposition. They may not be much more than grains of sand in size or may be about the size of a shot or pea, and may be very rough. Most of the stones are made up of cholesterin, lime salts, and bilirubin-calcium.

They may be classified as:

- (1) Pure cholesterin (not laminated).
- (2) Laminated (ninety per cent. cholesterin, bilirubin-calcium, biliverdin-calcium, calcium carbonate).

(3) Mixed cholesterin (common variety, usually smaller than a cherry).

(4) Mixed (bilirubin-calcium, seventy-five per cent.; cholesterin, twenty-five per cent.).

(5) Pure bilirubin.

(6) Amorphous and incompletely crystalline cholesterin (resembling pearls); calcareous stones; concretions with included bodies and conglomerate stones; and casts of bile ducts. (All rare.)

The mixed bilirubin are usually large, often single with round edges. The pure bilirubin stones vary from sand-like particles to the size of a pea. In consistency, the cholesterin stones are the softest; the older stones are harder and more friable.

The formation of stones is thought to be brought about as follows: Infection and catarrh of the ducts and gall-bladder with biliary stasis produces necrosis and desquamation of the lining epithelium, with albuminous exudation and greatly increased mucous and cholesterin formation. The increase in cholesterin is not derived from the bile but is produced by the destruction of the lining membrane. Bacterial growth (colon or typhoid, but not streptococci) alters the solvent action of the bile salts, allowing the precipitation of bilirubin-calcium which adheres to the particles of desquamated epithelium, débris, bacteria, etc., which often form the nucleus of the stone, and during recurring attacks of cholecystitis or exacerbations the additional layers or lamina are probably added.

Stones may also be formed in the ducts (usually the hepatic) and never contain cholesterin unless it gets there from the gall-bladder by retrograde movement.

Lesions associated with gall-stones may be mechanical or inflammatory. The mechanical lesions and disturbances usually result from the "wandering" of the stone through the bile ducts. The results of this passage of the stone may be: Complete or partial obstruction of the cystic or common ducts; dilatation of the ducts, and biliary cirrhosis—permanent jaundice; production of Riedel's lobe; dilatation of the gall-bladder, with mucous-hydrops due to obstruction of the cystic duct. The inflammatory lesions are usually due to

associated infection. Catarrh of the ducts and cholecystitis are constantly present, which in some cases progresses to acute suppurative empyema. Pericholecystitis with formation of adhesions is common.

Symptoms. The principal symptoms of gall-stones are due to the associated infection of the biliary tract, which results (1) in spasm of the wall of the gall-bladder or bile ducts (with pain); (2) in reflex disturbances of the stomach and intestines (hyperchlorhydria, spasm, constipation, etc.); (3) in adhesive pericholecystitis; (4) sometimes in perforation.

The symptoms of gall-stones vary greatly, from practically no subjective signs of the so-called "latent" or "silent" cases, to the typical attack of gall-stone colic. Although the patient may not complain of symptoms directly referable to the gall-bladder, symptoms referred to the stomach or gastrointestinal tract are very common. For years the patient may have a mild degree of indigestion, irregularly, with possibly a distaste for fatty foods which may produce a feeling of nausea, or flatulence, belching, hyperacidity, eructations, pyrosis, constipation, etc., and do very well on small amounts of bicarbonate or other alkalis. In other cases the early symptoms may be those of the associated catarrh, and a diagnosis of bilious attacks, sluggish liver, etc., may be made. In other cases there may be only a feeling of fullness or weight and distention in the epigastrium after meals, relieved by belching or vomiting. After an attack of indigestion there may be soreness or stiffness in the right side. During the attack, chilly feelings may be especially prominent. In many of these cases the stones are found only during the course of a routine, complete, gastrointestinal x-ray study in patients presenting principally gastric symptoms, or those in whom the direct or referred symptoms of the original focus of infection—such as chronic appendix—detract from or overshadow those produced by the stones.

If the stone is small and smooth it can pass through the cystic and common ducts, causing very little or no disturbance. However, if the stone is larger than the lumen of the duct, is angular, or has sharp edges, it produces the phenomena of gall-stone or hepatic colic.

Gall-stone colic is due to the struggle between the stone and the duct, the former is pushed onward but causes in its migration spasm and contraction of the latter. It meets with numerous obstacles in its passage; it must pass the series of Heisterian valves in the narrow cystic duct; and in the larger common duct, at the last moment, it must pass through the small orifice of the ampulla of Vater. The attack usually comes on a few hours after a meal. The onset is sudden. The patient is taken with a sharp pain in the right hypochondrium, radiating in various directions to the umbilicus, epigastrium, right shoulder, apex of the right scapula, and rapidly becomes more intense. The pain is often excruciating and the patient writhes with agony and begs for relief. The pain may be continuous but often occurs in paroxysms with very brief intervals. It is often associated with a rigor and increase in temperature to 102° or 103° F.

There is nausea and vomiting, with marked depression of the circulation, and shock, with profuse sweating, tachycardia, and feeble pulse. The right hypochondrium is usually markedly tender, often with enlargement of the liver and rigidity of the upper right rectus muscle. There is often pain on pressure over the lower part of the chest, in back, on the right side. Jaundice may or may not be present. The spleen is enlarged, and albumin and red blood cells are frequently found in the urine. The attack may last from a few hours (usually eight to twelve) to a few days or even a week. The pain frequently ceases abruptly, and indicates that the stone has attempted to pass through the cystic duct—which was too narrow for its passage—and dropped back into the gall-bladder; or, that it has reached the duodenum after its passage through the ducts. The end of the attack is often attended by the passage of a large amount of watery urine.

The *diagnosis* of acute hepatic colic is generally easy. The acute onset, with pain in the upper abdominal and thoracic regions, and tenderness over the gall-bladder, usually produce a characteristic picture which differentiates it from nephritic colic, the pain of which is usually in the lower abdomen. A chill with fever is more common with stones than with gastralgia. A history of previous attacks is helpful, and jaundice determines the diagnosis. In the more chronic cases the x-ray

can be depended upon to detect only about sixty per cent. of the cases.

Obstruction of the cystic duct is often followed by acute catarrhal or suppurative cholecystitis, pericholecystitis, dilatation (hydrops) of the gall-bladder, and calcification or atrophy of the gall-bladder.

Obstruction of the common duct may be complete or incomplete. Total occlusion of the common duct is not frequent but may be caused by a single stone or series of stones. The jaundice is intense and permanent. It may often be diagnosed from obstruction by new growths, by "Courvoisier's law" that a contracted gall-bladder in chronic jaundice suggests gall-stones, and a dilated gall-bladder in chronic jaundice suggests obstruction from other causes, particularly carcinoma of the head of the pancreas. With long continued obstruction the bile ducts become dilated, and the contents ultimately do not consist of bile but clear watery fluid. There may or may not be fever, depending on the presence or absence of infection. In incomplete obstruction there may be no jaundice but usually there are intermittent fever, chills, and sweats. There is always danger of acute or chronic pancreatitis following an attack. Frequent examination of the stools will determine whether the occlusion is complete or incomplete.

Other less common complications are: fistulæ (external, intestinal, bronchial); perforation into the portal vein, hepatic artery, urinary passages, and pericardium. Perforation into the peritoneal cavity is not infrequent. Obstruction of the intestine may occur.

Treatment. The treatment during the acute attack is directed principally to the pain, shock, and gastric symptoms. The patient should be given $\frac{1}{4}$ grain of morphin by hypodermic, and a smaller dose may be repeated if necessary. Atropin ($\frac{1}{50}$ grain) or nitroglycerin ($\frac{1}{100}$ grain) are often helpful and act as adjuvants with the morphin in relaxing spasm. During an especially severe paroxysm, chloroform inhalations may be necessary. Hot fomentations over the gall-bladder also often give relief. Food by mouth should be withheld during the acute stage. The nausea and vomiting usually stop with the pain but may be persistent. In

this case gastric lavage, alkalies, bismuth, carbolic acid, dilute hydrocyanic acid, cerium oxalate, sips of hot water and brandy, champagne, etc., may be tried.

Following the subsidence of acute symptoms the case is treated as one of chronic biliary infection.

Free drainage and sterilization of the bile and biliary channels is desired. To this end Lyon's method of non-surgical biliary drainage is very useful and in many cases may be successful. Hexamethylenamin, salicylic acid, and other germicidal drugs, may be tried. Other prophylactic and hygienic measures, such as correction of diet, sedentary habits, and constipation, are important. The diet should be carefully regulated and be mixed and of a character that is easily assimilated and does not produce congestion and overwork of the liver. For a time, fats, cream, etc., should be restricted. Large amounts of water should be taken, especially the alkaline and slightly aperient varieties.

Surgical interference is indicated when there has been more than one attack of gall-stone colic; when there is a distended gall-bladder associated with attacks of pain or fever; and when a stone is permanently lodged in one of the ducts.

The prophylactic treatment is to cure or at least improve existing states of catarrh of the ducts and gall-bladder, for which hope is held out by the non-surgical drainage of Lyon (see article on Cholangitis); to correct obesity, dietetic errors, constipation, local infectious disease of the gastrointestinal tract, colitis, chronic toxemias, and any other conditions which tend to produce an active or passive chronic congestion of the liver with resulting biliary stasis and catarrh.

The best treatment to prevent future attacks and the complications mentioned after stones are once present, of course, is surgical removal. This is advisable in all patients who have had two or more attacks, since with proper technique and a subject in good condition the risk is not great. (Mortality of 1.8 per cent. in nearly 3000 cases in which the gall-bladder alone was involved at the Mayo clinic.)

TUMORS OF THE GALL-BLADDER AND BILIARY PASSAGES.

Carcinoma is the most common tumor of the gall-bladder and biliary passages, and is practically always primary. Fibromata and adenomata have been described but are rare.

Cancer of the gall-bladder is more common in women (about four to one), and in more than three-fourths of the cases gall-stones are or have been present. It is still a question whether the stones are secondary or precede the growth. It is most commonly found between forty and fifty years of age.

Primary cancer of the gall-bladder may be columnar celled, encephaloid, colloid, or scirrhus. The fundus is most often involved. In other cases it may begin at the neck. The cavity of the gall-bladder is generally enlarged and the walls are hypertrophied. The tumor may invade the cystic and common ducts and narrow their caliber. Usually the stomach, colon, duodenum, or liver, are the seat of adhesions and they are often infiltrated with the growth. The neighboring lymph glands are usually involved. The liver is almost always invaded and may contain numerous nodules of secondary growth.

Primary cancer may attack any part of the hepatic, cystic, or common ducts. Most commonly it originates in the common duct. The ampulla of Vater may be the seat of the disease. The growth may develop insidiously upon symptoms of the associated stones and catarrhal cholangitis, and many patients for years complain of indefinite digestive symptoms referable to chronic cholecystitis.

When the disease attacks the gall-bladder, a hard, tender tumor may be palpated extending toward the umbilicus in the right hypochondrium and moving with the liver during respiration. Jaundice is frequently absent, but in the majority of cases (seventy-five per cent.) it occurs in variable degree, indicating that the ducts have become involved or are obstructed by pressure. Ascites occurs in about twenty-five per cent., due to carcinosis of the peritoneum or peritonitis. Pain is variable. It may be severe and occur in paroxysms. The pain and tenderness on pressure persist between paroxysmal attacks. There is rapid loss in weight,

cachexia, and, eventually, severe symptoms of cholemia become prominent. Cancer of the gall-bladder is fatal and usually runs its course in three or four months.

Primary cancer of the bile ducts is less common. It seldom forms a mass which is palpable. There is always jaundice, which is progressive, deep, permanent, and of a peculiar hue due to the cachexia. The gall-bladder is usually enlarged. Melena almost always points to the presence of cancer of the biliary passages. (Hanot.) Diagnosis of this condition is very difficult and may require exploratory laparotomy for confirmation. Carcinoma of the biliary ducts is suggested by insidious but persistent jaundice without determinable cause; smooth uniform enlargement of the gall-bladder, loss of strength and flesh in a patient about or over fifty years of age.

A *diagnosis* of cancer of the gall-bladder is warranted if, after a history of gall-stones, a hard mass is palpable in the gall-bladder region, accompanied by permanent jaundice, emaciation, and cachexia.

The disease is fatal, and the *treatment* is surgical. Exploratory laparotomy should be performed in all doubtful cases. Intensive x-ray or radium therapy may be tried to arrest the progress of the disease. Medical treatment is entirely palliative and symptomatic.

DISEASES OF THE PANCREAS.

ACUTE PANCREATITIS.

Acute pancreatitis is a serious affection, frequently causing death, and characterized by sudden onset, epigastric pain, and symptoms of collapse. It may be divided into two types: the hemorrhagic, and the suppurative. A third type is sometimes differentiated, the gangrenous, which is an advanced stage of the hemorrhagic form.

THE HEMORRHAGIC FORM.

This occurs more often in men than in women, and is distinctly a disease of adult life, few cases having been reported before the twentieth or after the sixtieth year. The disease not infrequently attacks individuals who have apparently

been in good health; individuals with abundant fat are, it is claimed, particularly susceptible. However, there is usually a history of more or less prominent digestive disturbances, the patient having suffered occasionally from severe pain and vomiting or gall-stone colic. Many of them have been addicted to alcohol. Some instances have been reported associated with parturition. In these cases the changes in the pancreas, no doubt, were analogous to those occurring in the liver and kidneys in eclampsia. Cholelithiasis is frequently associated with acute hemorrhagic pancreatitis (over forty-two per cent.). In not a few of these cases a biliary calculus has been found lodged in the diverticulum of Vater. Opie has called attention to the fact that a calculus so situated can prevent the exit of bile and pancreatic secretion from their respective ducts, and may divert the bile into the pancreatic duct. Experimentally, by injecting bile into the pancreatic duct he has been able to reproduce, in animals, the symptomatology and pathological changes which are found in human beings suffering from this disease. Others have shown that other foreign materials, such as dilute hydrochloric acid, nitric acid, duodenal contents, bacteria, or their products, etc., injected into the duct may also produce the lesion. Old contracting duodenal scars, cysts, and new growths, may also produce an obstruction to the common duct. The infectious diseases, and vascular degeneration, are important predisposing factors in producing the disease. Occasionally it may result from direct extension of an inflammatory process in another organ, such as gastric or duodenal ulcer.

Pathology. The appearance of the organ varies with the duration of the disease; and in accordance with the aspect of the gland, the lesion has been described as hemorrhagic, or gangrenous. After a few days of illness the pancreas is found enlarged, firm, and the interlobular spaces filled with blood and perhaps clots. There is usually bloody fluid in the lesser peritoneal cavity, and the tissues about the gland may be infiltrated with blood. There is extensive necrosis of the parenchyma, including epithelium, blood-vessels, and connective tissue. The line of demarcation between living and necrotic tissue is usually quite sharp. At first some struc-

tural characteristics may be made out, but later the tissue undergoes such alterations that the structures composing it are no longer recognizable. Any inflammatory reaction which may be present is secondary to the necrosis. Fat necrosis is practically always found associated with hemorrhagic (and gangrenous) pancreatitis, and areas may be found in the retroperitoneal fat, the mesocolon, and mesentery. After about ten days the stage of gangrene sets in. The pancreas is dark brown, dry, firm, and covered with changed blood. It has been found nearly entirely sloughed off, and attached to the abdominal wall by a few small threads of tissue. Areas of hemorrhage may alternate with yellow spots of softening. At the end of the second week the organ may be a soft, friable mass, while the lesser omental cavity contains a large amount of chocolate colored fluid. Disseminated fat necrosis is a conspicuous feature of this stage of the disease. "Recognition of the truth that necrosis of tissue is the essential feature of the acute hemorrhagic lesion, explains the relation of hemorrhagic to gangrenous pancreatitis. In individuals who die within one to three or four days after the onset of the symptoms, the gland is swollen and hemorrhagic, but when death occurs after a longer period there are changes in the hemorrhagic tissue so that it becomes black and gangrenous in appearance. It has been customary to describe as separate diseases hemorrhagic and gangrenous pancreatitis, whereas in both, the underlying change is death of pancreatic parenchyma, and the two conditions represent two stages of the same lesion." (Opie.)

Symptoms. The onset of symptoms in acute hemorrhagic pancreatitis is abrupt. An individual in apparent good health, or with a history of gastrointestinal disturbances, or gall-stone colic, is suddenly seized with severe epigastric pain and vomiting, followed by collapse. The pain is violent and colicky, and in the majority of instances *is not relieved by large doses of morphin*. It may be paroxysmal or constant, and is localized usually above the umbilicus, along the course of the pancreas to the left, in the hypochondriac regions, or occasionally below the umbilicus. Nausea and vomiting soon follow the onset of pain, and may be persistent and troublesome. The abdomen is swollen and tense. Constipa-

tion is marked. Symptoms of severe shock usually accompany the attack. The temperature at first may be low, but often fever sets in later, occasionally preceded by a chill. The patient breaks out into a cold sweat, and signs of circulatory failure become evident with extreme weakness and exhaustion. Death may occur within a few hours but usually not until the second to fourth days. Occasionally the trouble quiets down after a few hours, but more frequently it is fatal. The symptoms of onset may diminish in their severity or may not be as severe as described and the disease takes a more chronic course to the stage of gangrene. The presence of pain above the umbilicus, with recurrence of nausea and vomiting, and the presence of a tumor mass, are suggestive. Leucocytosis may be present but is not constant.

This condition may be mistaken for gall-stone colic, especially when jaundice is associated with it. The intense pain, not relieved by large doses of opiates, diffuse epigastric—location especially on the left side—and severe collapse symptoms, indicate involvement of the pancreas. The symptoms may sometimes simulate those of acute intestinal obstruction, but the location of the tumor in the epigastrium, absence of stercoraceous vomiting and visible peristalsis, help to differentiate it. Many times the diagnosis is made at operation by the presence of areas of fat necrosis, where perforation or acute obstruction had been suspected.

THE SUPPURATIVE FORM.

This form may be a complication of or a sequel to the hemorrhagic form, or of pancreatic hemorrhage. When not secondary to hemorrhagic pancreatitis it is with few exceptions the result of ascending infection by way of the pancreatic duct. It is often associated with cholelithiasis. A biliary calculus lodged in the diverticulum of Vater, and a catarrhal condition of the common duct, favor the entrance of bacteria into the pancreatic duct, especially if there is associated a cholecystitis or cholangitis. Pancreatic calculi are frequently accompanied by suppuration. Various organisms may be the cause, the most common being *Bacillus coli* and members of the pyogenic cocci groups. In some cases

the organisms may be brought by the lymphatics and more rarely by the blood stream.

Pathology. Suppuration may occur in the pancreas as a solitary abscess, multiple small abscesses, or as a diffuse inflammatory process. The ducts of the gland become dilated and filled with inflammatory products, leucocytes, and bacteria. From the ducts bacteria gain access to the acini, and by penetrating the wall of the duct find their way into the interlobular tissue. There may be many small communicating abscesses. When there is a single abscess cavity it is usually situated in the head. Fat necrosis is an infrequent accompaniment to suppurative pancreatitis, unless it is a sequel to the hemorrhagic form. Peritonitis affecting the lesser peritoneal cavity occurs almost constantly, and perforation into the general peritoneal cavity may follow. The abscess may rupture into the stomach or intestine. Thrombosis and infection of portal or splenic veins may be followed by metastatic abscesses in the liver.

Symptoms. The symptoms of suppurative pancreatitis vary greatly and are modified by associated or preceding conditions, such as acute hemorrhagic pancreatitis, cholelithiasis, pancreatic lithiasis, etc. In about one-half of the cases there is sudden onset, with intense epigastric pain, vomiting and collapse similar to hemorrhagic pancreatitis. The symptoms gradually decrease in severity and the disease runs a more or less chronic course, lasting from a few days to several months. In other cases the onset is more gradual and the symptoms less severe. The pain may be little more than discomfort with gastric disturbances. Usually there is irregular fever, which may reach 105° F. in some cases, occasionally accompanied by chills. Leucocytosis is usually present. Icterus is not an uncommon occurrence. Fatty diarrhea and glycosuria are occasionally met with but are not very common. The presence of a tumor mass in the epigastrium is of the greatest diagnostic importance.

The *differential diagnosis* between acute hemorrhagic pancreatitis and acute suppurative pancreatitis is often impossible because the symptoms of onset in both cases may be the same. The early appearance of fever and chills, with a high leucocyte count, suggests suppuration.

Treatment. The treatment of acute pancreatitis is surgical. Recovery from the uncomplicated hemorrhagic type is possible, but early drainage is essential in the suppurative cases. Attention should be directed to the profound collapse, and efforts made to support the enfeebled circulation. The shock is not due to hemorrhage but to the absorption of an extremely toxic material produced by the necrosis of tissue. Food by mouth should be discontinued and nutrient and stimulating enemata substituted. An enema of warm water may relieve the constipation and distention. Normal saline, intravenously or by hypodermoclysis, may be of considerable benefit when cyanosis and a feeble pulse are present. For vomiting and gastric dilatation lavage should be employed. Large doses of morphin are required to relieve the pain, though often this will only be accomplished by chloroform inhalations. Difference of opinion exists as to the best time to operate. In general it may be said that it is advisable to do so as early as the condition of the patient permits.

Probably little can be done in the way of prophylaxis except to correct hygienic errors, such as obesity, overeating, rapid eating, etc. Some cases no doubt can be prevented by surgical treatment of patients who have had more than one attack of gall-stone colic or cholecystitis.

PANCREATIC HEMORRHAGE.

Hemorrhage into the pancreas not infrequently results from injuries or blows in the epigastric region. "Pancreatic apoplexy" occasionally occurs following chronic alcoholism, arteriosclerosis, infectious diseases, and other conditions of vascular degeneration and degeneration of the parenchyma. The symptoms and treatment of pancreatic hemorrhage are the same as those of acute hemorrhagic pancreatitis, from which it cannot be differentiated clinically.

CHRONIC INTERSTITIAL PANCREATITIS.

Of the diseases to which the pancreas is subject, chronic interstitial inflammation is probably the most common, and yet very often it is not diagnosed during life because of the obscure etiology and indefinite symptomatology. Like sclero-

sis in other organs, the changes usually progress slowly over a long period of time, and very often accompany chronic disease of other abdominal viscera. Thus the majority of cases are found in late middle life, more than two-thirds between forty and sixty years. It is somewhat more common in men than in women. It may form a part of a generalized sclerosis of the abdominal organs or be associated with more local conditions, in particular those that obstruct the pancreatic duct. Pancreatic calculi in the pancreatic duct, biliary calculi in the common duct, and pressure from new growths, may bring about a partial or complete occlusion of the duct. Since the accessory pancreatic duct (Santorini) is usually small and rudimentary, stasis of pancreatic secretion follows occlusion of the larger duct, and chronic pancreatitis results from the irritative action of the retained secretion on the secreting cells. Chronic pancreatitis is frequently associated with disease of the gall-bladder, especially stones. Induration and enlargement of the head of the pancreas is often reported at operations for gall-stones; as high as sixty per cent. have been reported in cases of stone in the common duct. Second in importance to obstruction of the duct is infection. It may be of the ascending type following gastroduodenitis or infection of the biliary tract. In the latter instances infection of the pancreatic duct is greatly facilitated by a calculus in, or a partial obstruction of, the common duct. The lymphatics may carry the organisms or more rarely they may be brought through the blood-stream. The infecting organisms are usually of the colon or streptococcus groups, but occasionally may be of the typhoid group. Degenerative vascular changes, arteriosclerosis, and circulating poisons such as the products of chronic intestinal toxemias, tuberculosis, infectious diseases, syphilis, nephritis, and metallic poisons, are also important factors in bringing about sclerotic changes in the organ. Chronic pancreatitis is commonly found associated with cirrhosis of the liver. Since cirrhosis is often due to a low-grade chronic infection brought by the portal system, it is not unreasonable to suppose that a descending infection of the bile ducts may result and give ample opportunity for an ascending infection of the pancreatic duct to take place.

Pathology. Histologically the sclerosis may be of two types, the interlobular and the interacinar. The interlobular form commonly follows obstruction of the pancreatic duct and ascending infection. The increase in connective tissue begins at the periphery of the lobule, making the organ firm and much more definitely lobulated, and then gradually invades the lobule and encroaches on the parenchyma. The islands of Langerhans, during the early stage, are not involved in the process and even late in the disease they are very resistant. On the other hand, in the interacinar type the fibrosis takes place primarily within the lobule, separating acini and individual cells by strands of connective tissue. The islands in the latter type are attacked early, the sclerosis taking place in and around them, particularly about the capillaries. The interacinar type is found in the toxic cases with marked arteriosclerosis, following alcoholism, the Laennec type of cirrhosis, etc. It is important to note that the interlobular type—which spares the islands of Langerhans until a very advanced stage—is rarely accompanied by diabetes, whereas the interacinar type—which attacks these structures early—is almost always accompanied by diabetes mellitus.

Symptoms. The symptomatology of chronic pancreatitis may be poorly defined or may be masked by associated conditions. The onset is slow and insidious. A history of long standing “dyspeptic” attacks, or recurring rather indefinite digestive disturbances with slight pain just above and to the left of the umbilicus after eating, is obtained in many instances. There may be an intolerance for fatty foods, to which the patient may attribute the attacks, or he may have a marked aversion for them. Anorexia and slow progressive loss of weight with secondary anemia are commonly present. Later, as the disease advances, vomiting and “fatty” diarrhea may be prominent features. The stools become light colored, bulky, and an excess of neutral fat can be demonstrated by the usual chemical and microscopic methods. A source of error in this examination may arise in cases where the patient is taking mineral oil, the use of which has become widespread. When the proteolytic enzyme, trypsin, is deficient, undigested meat fibers and pieces of meat are easily detected

in the stool. If the common duct is obstructed or compressed, jaundice becomes marked. Glycosuria and low sugar tolerance are symptoms of serious import, as they indicate an advanced condition and a transition to a true diabetic state. Occasionally the liver and spleen may be found enlarged.

The symptoms of gall-bladder disease, gastroduodenitis, cirrhosis, or other associated conditions, being of a more acute and distinctive type, often cause the pancreatic disturbance to be overlooked. An early diagnosis is often not possible due to the mild character of the symptoms. However, when a patient with a history of mild and indefinite digestive disturbance has shown a steady, slow but progressive loss of weight with anorexia, chronic pancreatitis should be suspected in the absence of a demonstrable organic lesion by x-ray or physical examination. The method of examination which gives most promise is that of Einhorn, for examination of the duodenal contents (including pancreatic juice) by means of the duodenal tube after stimulation by a suitable test meal. The method is not complicated and can be carried out by any practitioner who wishes to spend the necessary time. One, two or all three of the enzymes may be deficient or lacking. Recently some modifications such as fractional examination, at various periods of time after the ingestion of a test meal, have been advocated. It is too early as yet to comment on their value. Only in recent years has this important phase of pancreatic physiology and pathology been receiving the study it deserves. Other chemical laboratory tests have been devised but seem to be of doubtful reliability.

Jaundice often makes the differentiation of chronic pancreatitis from other affections of the biliary system difficult. The loss of weight; diarrhea; azotorrhea or steatorrhea; and location of pain to the left when it is present, help to differentiate it from gall-bladder disease. These symptoms, with negative findings in the gastric test meal, differentiate it from gastric conditions.

Treatment. If the etiologic factors can be recognized in a given case and corrected, the progress of the disease may be arrested. The prophylactic treatment of these cases depends on the recognition and removal of as many of the fac-

tors as possible, which may be contributory to the disease. The early surgical treatment of individuals having repeated attacks of gall-stones or cholecystitis is important. The method of biliary drainage advocated by Lyon seems to be successful in treating infections of the bile ducts and radicles, which may be the source of pancreatic infection. The factors which tend to produce arteriosclerosis should be corrected, such as overeating, alcoholism, toxemias, and chronic infections. Chronic intestinal toxemia and focal infections are important in this connection.

The treatment is directed toward draining the biliary system if infection is present; diet; and supplying pancreatic enzymes which may be deficient. Lyon's non-surgical method of drainage is of considerable value where a mild or low-grade infection of the biliary passages exists, but where cholecystitis or cholelithiasis is present surgical intervention is usually required.

As far as possible the diet is made to fit the requirements of the individual case. The food should be thoroughly masticated and eaten slowly in order to mix it well with saliva and thereby derive the greatest amount of benefit from the digestion of carbohydrates by the ptyalin. Depending on the amount of deficiency of enzyme and the stage of the disease, fats and meat are restricted or omitted. Following are two sample diets. The first is designed primarily for patients having steatorrhea as the predominant deficiency symptom, and the second for those having azotorrhea as the predominating deficiency symptom. One or the other, or a combination of these diets,* may be used to meet the needs of the individual case.

For steatorrhea:

This diet comprises two types for different days in the week. These are designated "Fat Feast Days" and "Fat Fast Days." Just the number of each in the week that are proper for the patient remains to be worked out, but in the start they should alternate, that is, one "Fast Day," the next a "Feast Day," then a "Fast Day," the next a "Feast Day" and so on until advised differently.

SUGGESTIONS FOR ALL DAYS.

Drink a glass of Celestines Vichy, Kalak or plain water before breakfast, and at 12 M. Do not drink anything until the end of the meal, but

* Diets and prescriptions by courtesy of Dr. Anthony Bassler.

take about eight glasses of water or fluid in the course of each day. Carlsbad salts or sodium phosphate are the best laxatives to take when necessary. The meals should be frequent and in smaller amounts, if this is practical, if not, three meals a day will do.

FAT FAST DAYS.

Fruits of all kinds, fresh, baked or stewed.
 Berries in season, with sugar but no milk or cream.
 Any vegetables at all, and cooked in any way, but no milk or butter should be used in their cooking or eating.
 Cereals of all kinds, cooked in plain water and eaten with sugar only.
 Any kinds of breads, crackers, dry toast, etc., without butter.
 Marmalade, jam, or bee's honey.
 Raw oysters.
 Soup of any kind in limited quantity, providing there is no fat in it.
 Weak tea or coffee, no milk or cream.
 Skimmed milk and fat-free buttermilk.
 The five foods especially to be avoided on these days are: eggs, cream, butter, meat, and fish.

FAT FEAST DAYS.

All of the above with the addition of well cooked lean meats and fish (excluding salmon, shad, and bluefish). In the cooking and eating of these, instead of butter, use oleomargarine.

As the fat in milk is fairly well absorbed even in the absence of pancreatic digestion, a moderate amount is allowed on these days.

For azotorrhea:

The plan you should follow is to partake of only soup or fluid foods, and such solid foods as are taken should be cut very fine. Eat oftener than three times a day if possible. Wash all foods. The following comprises the diet:

SOUPS.

Split pea.	Tomato bouillon with rice.
Lentil.	Barley.
Creamed soups.	Gumbo.
Any of the meat broths.	Bisques.
Oyster.	Mock bisques.
Vegetable.	Victoria soup.
Bouillon with egg.	

EGGS.

Two a day.	Steamed or baked.
Soft boiled.	Omelette.
Poached on toast.	Any form.

MEAT SUBSTITUTES.

Scrambled eggs, spinach, potatoes.	Fried mushrooms on toast.
Vegetable hash.	Oysters, any form.
Nuts, macaroni, potatoes.	Fresh fish, creamed, baked, roasted
Chili con carne (Mexican style)	and boiled.
with boiled rice.	American or cream cheese.
Combination of four vegetables.	

VEGETABLES.

Boiled potatoes.	Baked beans.
Riced potatoes.	Beets.
Mashed potatoes.	New England boiled dinner.
Creamed potatoes.	Boiled carrots.
Baked potatoes.	Green peas.
Spaghetti.	Spinach.
Mashed turnips.	Steamed corn and rice.
Lima beans.	Rice and grated carrots.
Boiled onions.	Stewed corn.
Creamed onions.	Spaghetti and tomatoes.
Beans and rice.	Lentils.

CEREALS.

Rice and raisins.	Fruit and cereal.
Rolled oats.	Cracker gruel.
Gluten breakfast food.	Rice.
Whole wheat.	Barley gruel broth.
Cracked corn.	Farina.
Natural rice.	Sago.
Hominy.	Oatmeal gruel.
Corn meal mush, honey.	

FRUITS.

<i>Fresh.</i>	<i>Stewed.</i>
Raisins.	Prunes.
Pineapple.	Compot.
	Baked apple.
	Rhubarb.
<i>Baked.</i>	<i>Preserved.</i>
Banana.	Peaches.

SALADS.

Fruit.	Lettuce.
Fruit and nut.	Celery.
Vegetable combination.	Ripe olives.
Mock chicken.	Tomatoes.
Sliced onions.	Romaine.
Potato.	Watercress.

DESSERT.

Rice pudding.	Chocolate pudding.
Bread pudding.	Custards.
Raisin pudding.	Meringue.
Fruit pudding.	Fruit whips.
Cereal pudding.	Souffles.
Chocolate cake.	Junkets.
Banana cream cake.	Gluten pudding.
Fruit charlotte.	Tapioca cream.
Honey.	Gelatin.
Fruit shortcake.	Jellies.
Corn starch.	Fruit creams.

BEVERAGES.

Cocoa.	Orangeade.
Milk.	Lemonade.
Buttermilk.	Yerba mate.
Kaffee Hag.	Fruit juice and water.
Orange juice.	Plain cool water.

Whole pancreas, or various extracts of the pancreas, may be utilized to supply the deficient enzymes. The whole pancreas may be pickled over night and a portion eaten with each meal. Powdered whole gland is also efficient. Pancreatin may be used in doses from 5 to 10 grains. Alkalies should be used in conjunction with the pancreas or pancreatin. The following prescriptions have been found useful:

℞ Natrii bromidi	3v.
Pancreatini	3v.
Glycerinæ	3iv.
Tinct. cardamomi	3i.
Aquæ	q. s. ad 3iv.

Fiant Mist.

Sig.: One teaspoonful in water after meals.

℞ Natrii bicarbonati	āā 3ss.
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Div. in Pulv. No. 24.

Sig.: One powder in water after meals.

℞ Oleoresinæ capsici	℥ij.
Pancreatini	gr. xx.
Carbonas ligni	gr. xl.
Creosoti	℥x.

Fiant Pil. No. 20.

Sig.: One pill after meals.

Many of these cases are in a more or less poor state of endurance, are asthenic, and have a tendency to be neurotic. Along with the diet and medication, general hygienic measures should be used. The patients should be out in the fresh air as much as possible and get a certain amount of non-competitive exercise every day. One of the best ways of accomplishing this is by playing golf. Tennis played sporadically in most cases would be too strenuous. Where the patient's time and means do not permit this form of exercise, the usual "setting up" exercises, such as those used in the army or gymnasiums, if persisted in, often bring about very

beneficial results. Various kinds of baths and massage may be of considerable benefit. They should take sufficient rest at night, in well ventilated rooms, and avoid overtaxing their endurance. Any of the usual tonic medicines may be used with the treatment outlined above, including such drugs as strychnin, iron, arsenic, or any others that may benefit the general condition.

TUMORS OF THE PANCREAS.

Carcinoma is the most common tumor of the pancreas. It occurs more frequently in men than in women and is usually found in middle aged persons, although a few cases have been reported of its occurrence in early childhood. It is usually primary. Occasionally it invades the pancreas by direct extension from neighboring organs, such as the stomach, duodenum, and common bile duct. More rarely it may be metastatic. The head is much more commonly affected than other parts of the gland.

Pathology. Cancer of the pancreas usually is of the scirrhous variety and is hard and firm, with the cancer cells embedded in a dense fibrous stroma. Occasionally it is soft or encephaloid. Colloid cancers and cystic epitheliomata have been described.

Symptoms. The most constant symptom of cancer of the pancreas is pain. It may be continuous, intermittent, or come in paroxysms of colic. It is usually situated in the epigastrium just above the umbilicus but may be in either the left or right hypochondrium. It may radiate to the back, sternum, or shoulders. The presence of a tumor mass in the epigastrium very often cannot be demonstrated. To be palpable the tumor must be of large size because of its anatomical position, especially in large individuals who have much fat in the abdominal wall or who are very muscular. Tenderness, ascites, and distention from any cause, may interfere with palpation. Osler recommends examination with an empty stomach, under an anesthetic. Very often pulsations from the aorta are transmitted and occasionally a bruit may be heard. However, the tumor is not expansile and may move with respiration. Pulsation is absent when palpated in the knee-chest position. Functional disturbances are more

common in cancer than in other diseases of the gland. Digestive disturbances, with nausea, belching, distention, and discomfort after meals, are frequently present and may be the earliest signs of the disease. There is loss of appetite, with a distaste for fatty foods, and a rapid emaciation and cachexia with marked anemia and weakness. Azotorrhea and steatorrhea are occasionally met with. Constipation is more common than diarrhea, or they may alternate. With deficiency the stools are usually bulky but may appear normal. Vomiting comes on late in the disease when the tumor has become large enough to cause more marked deficiency of secretion, and obstruction of the duodenum or pylorus by pressure or direct involvement. When the growth is in the head of the pancreas, which is the most common location (sixty to eighty per cent.), jaundice is constantly present from obstruction of the common bile duct. It is permanent, without remission, progressive, intense, dusky, and with the cachexia gives a peculiar coloration. Associated with the jaundice is a marked non-inflammatory dilatation of the gall-bladder. Glycosuria is not an infrequent accompaniment to carcinoma of the pancreas.

As the cancer increases in size it may invade neighboring organs or cause symptoms due to pressure on these organs. Pyloric or duodenal obstruction with gastric retention and dilatation may be produced. Also the transverse colon may be obstructed by pressure. Obstruction of the inferior vena cava causes cyanotic edema of the subdiaphragmatic half of the body. When it compresses the portal vein it causes ascites and collateral circulation. The growth may also invade the prevertebral glands and superior mesenteric artery. Involvement of the latter is usually followed by intestinal infarction, bloody diarrhea, and peritonitis.

Adenomata, sarcomata, and lymphomata are rare. Occasionally an adenoma is found at autopsy, not having caused symptoms during life. Symptoms of sarcoma are similar to those of carcinoma. The tumor in this case may grow very rapidly.

Cancer of the head of the pancreas must be differentiated from other conditions causing an obstruction to the common duct. The jaundice of cholelithiasis usually comes on more

quickly and is accompanied by a more definite colic. A slowly progressing jaundice, which becomes deeper without remissions, accompanied by a rapid loss of weight, cachexia, marked anemia, large dilated gall-bladder, and the presence of a tumor mass in the epigastrium, make the diagnosis of malignant disease of the pancreas probable.

Treatment. The treatment of cancer of the pancreas is palliative. All cases run a rapid course, extending on an average, from two to ten months. The treatment for the symptoms of pancreatic functional deficiency is essentially the same as that outlined for chronic pancreatitis. Pancreatin or whole pancreas, in conjunction with alkalies, may be used to furnish the deficient ferments. Several operative procedures have been advocated for the relief of jaundice and obstruction of the common bile duct. The one most commonly used is cholecystenterostomy. It may be necessary to relieve obstruction of the pylorus or duodenum by gastroenterostomy. Other complications are treated symptomatically as they arise.

Recently deep röntgentherapy has been receiving much attention and very optimistic claims have been made for its use in the treatment of inoperable cancers of the abdomen and pelvis. It is at least worth a trial as a palliative measure in these cases, since removal of the growth by surgery is impossible.

CYSTS OF THE PANCREAS.

Cysts of the pancreas occur with about equal frequency in men and women. Most of the cases are detected during adult life, between twenty and fifty years of age. The majority of true cysts are found in women, while the traumatic or pseudocysts occur most often in men.

Pathology. These cysts are usually classed as true cysts, pseudocysts, and hydatid cysts. The true cysts include the so-called retention cysts, proliferation cysts, and congenital cysts. Pseudocysts include a variety of conditions in which there is a collection of fluid adjoining the pancreas, usually in the lesser omental cavity, the wall not being composed of pancreatic tissue.

Retention cysts are thought to be due to partial or intermittent occlusion of the pancreatic duct. This occlusion may be brought about by obstruction by calculi in the pancreatic or common bile ducts, and by pressure from without by tumors, swollen lymphatic glands, and adhesions. These cysts are often found associated with chronic interlobular pancreatitis, but it is frequently difficult to determine whether the pancreatitis is primary or secondary to the cyst formation. There may be a single large cyst or they may be multiple. Very often there are many small ones present which do not cause symptoms. As the cyst enlarges, the lining epithelium becomes atrophied and the wall becomes thick and fibroid, sometimes attaining a thickness of three to four millimeters. Destruction of the neighboring parenchyma and interstitial inflammation are usually present. Occasionally the wall is covered by large blood vessels.

The *proliferation cysts* may be benign or malignant. The benign, cystadenoma, is usually multilocular and is lined by columnar epithelium, having papillary projections. The rare malignant type, cystic epithelioma, is also multilocular, with patches of carcinomatous tissue in its walls. Metastatic deposits are found in the liver, lymphatic glands, and duodenum.

Congenital and hydatid cysts are rare.

Pseudocysts are most commonly found in men. They are usually caused by traumatism to the pancreas, either by a direct blow to the epigastrium or by continuous pressure. It may also follow recovery from acute hemorrhagic pancreatitis and pancreatic hemorrhage. The cyst may be found within the substance of the gland but the majority are found in contact with it. Pancreatic juice, pus, or blood, escaping into the lesser omental cavity, set up a peritonitis which closes the foramen of Winslow. The wall of the cyst is composed of dense connective tissue and does not have an epithelial lining. The cyst may become pedunculated.

Pancreatic cysts usually contain a clear colorless fluid, which may be tinged yellow. It may also be dark red, brown, yellow, or bright red from recent hemorrhage. They may contain blood cells, epithelium, crystals, and leucocytes. Albumin can usually be demonstrated. The specific gravity ranges from 1.008 to 1.030.

The pancreatic enzymes may be present but are not constant.

Symptoms. The symptoms of pancreatic cyst vary greatly. Many of the small cysts are present throughout the lifetime of an individual, without symptoms. Some of the large cysts have been present for a long period of time, with few or no symptoms except the presence of the tumor. There may be a history of digestive disturbances, traumatism, acute pancreatitis, or colicky pains due to pancreatic lithiasis. Any or all of the subjective symptoms of pancreatic disease may be present. There may be pain in the epigastrium or just above the umbilicus. It may occur in paroxysms of colic, or may be just a distress or discomfort. Symptoms of deficiency, such as azotorrhea and steatorrhea, may be present but are not common. Anorexia and loss of weight are frequent manifestations of the disease. Nausea may be present. Vomiting is usually not present unless the cyst is large and produces pressure on the stomach or duodenum. Often aortic pulsations are noted, but the mass is not expansile. Other symptoms may be caused by pressure and are referable to the organ involved. Pressure on the inferior vena cava causes edema of the lower extremities, and pressure on the portal vein causes ascites and evidences of an established collateral circulation. When the cyst is large and situated high in the abdomen, dyspnea may be present. Intestinal obstruction is rare, although some stasis is occasionally produced.

The location of the palpable tumor mass depends on the relative positions of stomach, cyst, and colon. The cyst usually lies in the lesser peritoneal cavity, pushing the stomach upward and lying between the stomach and colon, or it may lie above the lesser curvature, between the stomach and liver, and push the stomach downward. More rarely it may develop between the leaves of the transverse mesocolon and lie below both the stomach and colon.

Pancreatic cysts may be mistaken for splenic enlargement or tumors of the kidney, ovary, or mesentery. It may also simulate enlargement of the gall-bladder. However, a fluctuating tumor in the epigastrium, usually having the stomach above and colon below; which does not move with respira-

tion; is not expansile; and absence of pulsation in the knee-chest position, are suggestive of pancreatic cyst. The relative positions of stomach and colon may be more easily made out by percussion after inflation by carbon dioxide. The x-ray is also a great aid in making the diagnosis. The usual fluoroscopic examination, with a barium meal or enema, may give important information. In cases where the diagnosis is still doubtful, the method of x-ray examination with pneumoperitoneum may be tried, as it often reveals the presence of new growths which cannot be shown by the usual methods. With careful asepsis this method has been found to be practically harmless in the hands of a careful röntgenologist co-operating with a surgeon. Aspiration for diagnosis is dangerous and should not be attempted.

Treatment. The treatment is surgical and consists in extirpating or draining the cyst. Puncture and tapping the cyst are dangerous and ineffectual.

PANCREATIC CALCULI.

Pancreatic lithiasis is a comparatively rare disease, most cases being found at autopsy or operation. The calculi are usually multiple. They vary in size from small particles like sand to stones several centimeters in diameter. They may be round, smooth, rough, or spinous and coral-like. The color is usually white, but it may be gray and occasionally is brown or bile-stained. They are opaque and consist principally of inorganic salts, of which calcium carbonate and calcium phosphate form the largest amount. Magnesium sulphate, magnesium phosphate, and other salts, are occasionally found. These stones may be hard, or friable and brittle. They are supposed to be caused by a stasis of pancreatic secretion and low-grade inflammations of the ducts in which they are found. Bacteria and epithelium have been found in them, forming a nucleus.

Pathology. The calculi tend to cause a chronic interstitial pancreatitis of the interlobular type, by obstructing the flow of pancreatic secretion, which may be followed by infection. Surrounding the ducts in the vicinity of the calculi a marked fibrosis occurs, destroying the parenchyma. The islands of Langerhans are not involved until late in the process. Ob-

struction of the ducts by calculi may lead to ulceration and infection followed by abscess or suppurative pancreatitis. Obstruction is followed by dilatation of the duct and by formation of small retention cysts.

Symptoms. Calculi of the pancreas are infrequently diagnosed. There usually is pancreatic colic, accompanied by vomiting and a tendency to syncope. The pains radiate toward the first lumbar vertebra, between the shoulders, to the groins, and into the deep parts of the abdomen. The stools may show evidence of pancreatic deficiency by the presence of fat or muscle fibers. Temporary jaundice is sometimes present. Pancreatic calculi have been found in the stools. Alimentary glycosuria and diabetes mellitus are frequently present. Diagnosis by x-ray has been reported as possible, although usually the shadow of the spinal column interferes with such examinations.

Treatment. The medical treatment is essentially the same as that of cholelithiasis. The patient is kept at rest, hypodermics of morphin and atropin may be given for relief of pain, and heat applied to the epigastrium. Food is withheld until the acute attack passes off and then the treatment is the same as that for chronic pancreatitis. Water, plain or carbonated, is given in large quantities. Ten minims of pilocarpin, in one per cent. solution, by hypo three times a week, has been recommended. Surgical intervention has also been advocated but the disease is so seldom diagnosed that there are few cases on record. Occasionally pancreatic calculi cause suppuration, in which cases surgical drainage is necessary.

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Diseases of the Male Genito- urinary Tract

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Diseases of the Male Genito-urinary Tract.

INFECTION.

THE infections of the urinary tract, particularly those arising from venereal diseases, are probably the most important to middle life. This is because of the large percentage of individuals who have harbored an infection at one time or another, of the many insults thrust upon the urinary tract, of the many complications that are not entirely cleared up, due either to lack of coöperation on the part of the patient, or failure of recognition and therefore escape from adequate treatment, becoming foci for local or general ailments in later life. In a recent analysis of one hundred consecutive cases admitted to the men's medical ward of a general hospital, it was found that about thirty-three per cent. harbored some infection in the urinary tract, while approximately only four per cent. were admitted with urinary symptoms.

BALANITIS AND BALANOPOSTHITIS.

The inflammation of the glans penis is known as balanitis and together with the reflected layer of prepuce in apposition, is balanoposthitis. The most common cause is the decomposition of accumulated smegma under a phimosis. This predisposes to infection with the common pus producing organisms.

This condition may be prevalent in the uncircumcised and those individuals of uncleanly habits—particularly of washing the glans. Balanitis often accompanies an infection of the urethra.

The course may be mild, but occasionally may produce several ulcerations and infection lasting several weeks.

The symptoms vary from slight itching or burning, sense of heat, redness, swelling, discharge which has an offensive odor and excoriation to marked swelling, inflammatory

changes, with formation of lymphadenitis. Condylomata or venereal warts may develop, and occasionally gangrene. Hypertrophy of the foreskin may be noticed in middle-aged men and is due to organization of the inflammatory infiltration in the acute or subacute stage. It may be followed by epithelioma.

Chancroid and syphilis may develop together with a balanitis and must be recognized and proper treatment given.

Prophylactic treatment consists mainly in cleanliness. After the infection starts cleanliness is the chief object. When the prepuce can be retracted, the glans and reflected layer are washed with a mild antiseptic solution, dried and dusted with an astringent powder. This should be done several times a day. Equal parts of calomel and bismuth or alum have proven beneficial. If the prepuce is unretractable it may be necessary to perform a dorsal slit under local anesthesia, in order to make sure that a syphilitic or chancroidal ulcer is not present.

Circumcision is advised after the infection has subsided.

Balanitis causes no change in the general health and acts simply as a local irritation. It predisposes to epithelioma. The occasional complication of inguinal adenitis may keep the patient in bed for a week or longer.

HERPES PROGENITALIS.

The causes and treatment are practically the same as those of balanitis. Herpes produces no permanent pathology. The recurrent cases should have the cause removed, such as phimosis or redundant prepuce.

Herpes plays no rôle in the general health, but the patient usually becomes alarmed at a recurring condition, even though he is assured that it is not serious and no permanent damage will result.

PENIS.

Acute inflammation of the penis is usually due to trauma, infection or extravasation of urine, which may produce gangrene.

The chronic inflammation, particularly of the corpus cavernosa, produces a slow induration which may even become calcareous. The condition may be painless and only discovered by causing changes in erection. This is noticed in

middle life particularly in those suffering from gout, or chronic arthritis. These calcareous plaques may become the size of the thumb nail and after a time interfere markedly with erection.

The prognosis is poor. Treatment is directed along general lines—diet, hygiene, etc., but has little effect upon the condition which usually gets progressively worse. In the fibrous stage injections of fibrolysin have benefited; in plaque cases the excision of the plaques has been performed with benefit.

URETHRA.

Urethritis is usually classified as specific or non-specific, although at times in chronic cases it is difficult to differentiate between them. The “flare up” seen occasionally in chronic urethritis due to a fresh insult in one form or another, may be due to the gonococcus but it may not be demonstrable under the microscope.

In the specific urethritis, the infecting organism is the gonococcus, which is revealed as a Gram-negative, intracellular diplococcus. It is exceedingly difficult to obtain in pure culture on any media and especially when cultured from urethral pus.

The non-specific urethritis is caused by other organisms or by irritation from any source. The treatment is essentially the same.

The inflammation begins at the meatus and spreads backward. The usual pathology of inflammation occurs along the urethral canal, with the mucosa and its follicles swollen and infiltrated. It becomes covered with an exudate and soon the epithelium exfoliates. The gonococcus penetrates deeply into the submucosa, producing a round cell infiltration, which may cause a periurethral abscess.

A discharge is present which may vary considerably, being slight or copious, thin or thick, watery or purulent—most often a thick, yellowish, greenish purulent material. Occasionally there may be some blood. The discharge often crusts around the meatus.

The urine becomes cloudy due to pus and shortly will contain shreds of the urethral epithelium loaded with leucocytes.

In the typical case there is noticed first a slight itching or burning around the meatus. Later there may be distinct pain, which occasionally is severe. A sense of moisture is noticed and perhaps a slight discharge. Burning on micturition is experienced and is usually accompanied by frequency and often urgency.

The meatus becomes inflamed and edematous, which may extend to the entire glans. Painful erections are common.

The infection may remain in the anterior urethra and subside promptly, but more commonly the posterior urethra becomes involved, with an aggravation of symptoms. The urine becomes cloudy in the second glass, frequency is more marked together with urgency and ardor urinæ. Retention of urine has occurred. Chordee is frequent. There may be general symptoms from septic absorption.

The duration is about from four to six weeks in uncomplicated cases, depending largely on the individual and how instructions are carried out.

The treatment is divided into prophylactic, abortive and curative. Prophylaxis is the most important and has received special attention during the war and since. An attempt has been made to educate the public as to the serious character of any venereal infection and how it may be prevented. Prophylactic packets may now be obtained in any drug store. The efficiency of any treatment depends upon how soon after exposure it is carried out. Reports have been issued from many military medical stations approximating one hundred per cent. of prevention in those that received prophylaxis in the first or second hour after exposure.

The instructions are usually: first urinate, then wash the genitalia with soap and water. Protargol, two or three per cent. solution, is injected into the anterior urethra and held there for several minutes. Calomel ointment (thirty-three and one-third per cent.), is then applied over the genitalia, rubbed in and allowed to remain the next day.

Should a patient present himself in the first few hours of his infection, with a discharge which is still mucoid in character, but in which the gonococcus is still demonstrable chiefly as an extracellular organism, the abortive treatment may be considered. It is not always effective and in fact may

augment the condition. In our hands the "sealing in" method has not proved effective. The usual precautions for cleanliness are carried out and a three per cent. solution of protargol is injected into the anterior urethra three times a day, gradually decreasing the strength of the protargol. The discharge is usually worse for the first few hours after which it should subside. The gonococcus should disappear promptly, but if present after the fifth day, the abortive treatment should be abandoned and the usual treatment carried out.

The curative treatment, so-called, of urethritis depends largely upon the patient and how he conducts himself. His coöperation is essential and he must be made to understand this fact and carry the treatment out until he is discharged. Too frequently it is thought when the discharge ceases, the patient is cured.

The infectious nature of the discharge must be explained and the danger of infecting the eyes, although we believe that the risk of gonorrheal ophthalmia is greatly overrated. A gonorrheal bag is advised while the discharge is present and not a piece of cotton stuck in the meatus, which acts as a cork. A well fitting suspensory should be worn.

All exercise is prohibited and the patient is warned to keep off his feet and recline as much as possible. The best procedure is to spend the first few days in bed, but few will consider this. All sexual excitement is forbidden—even the society of women should be avoided. Sleep should be in seven or eight hour periods with light covering and arising immediately upon awakening.

The acids, spices and red meats are restricted from the diet, which should be as simple as possible. The drinking of large amounts of water is perhaps the most important factor in a speedy cure. Alcoholic and carbonated beverages are especially bad. Free evacuation of the bowels is most important.

The medication in the acute stage consists of the administration of salol in capsules or hexamethylenamin by mouth, with possibly the balsamics or sandalwood oil later on. Of these hexamethylenamin is the least likely to upset the stomach.

The local treatment in the anterior cases consists of injections of protargol, beginning with one-fourth per cent.

and gradually increasing to one per cent., and argyrol five to ten per cent. into the anterior urethra. Urination should always precede the injection, which should be held in for ten minutes, or until it burns. A bulb syringe is the best instrument for this purpose. Anterior irrigations of potassium permanganate 1:16000 to 1:4000 are also used.

It is usually well to wait several days after the infection has spread posteriorly before employing total irrigations, because there is an increase in the symptoms. Total irrigations are then begun and carried out daily until the urine becomes clear and remains so, providing the patient is not distressed too much by this procedure. Those patients who strain considerably and are irrigated with great difficulty are apt to develop an epididymitis and had better be kept on other treatment until the acute symptoms have subsided.

Potassium permanganate in strength varying from 1:16000 to 1:4000 enjoys the reputation of being the "old reliable." There is always something new on the market for which is claimed distinct superiority, but to date, after using nearly all the drugs or dyes that have made their appearance in the last decade, we have always returned to potassium permanganate, believing there is nothing better in the general run of cases. Silver nitrate is used considerably in strengths varying from 1:16000 to 1:6000 with good results and occasionally there are cases which respond better under its use than anything else.

Bacterin and serum therapy are not employed unless there are complications.

The duration of an attack of urethritis is regarded as from four to six weeks. After six weeks it is considered chronic.

The question of cure is a most important one and often difficult to determine. When a patient is free from all symptoms, the urine is clear with no shreds, the prostate and seminal vesicles normal to palpation, and the secretions expressed by massage free from pus as determined by the microscope, and with a urèthra of normal caliber, he is put on a month's probation on good behavior. It is not desirable that any provocative measures of any kind be tried, as they often do harm. If at the expiration of a month the same tests are applied and are found negative, the patient is told he is free of disease.

Those individuals whose urine contains shreds due to pus (not epithelial nor mucus) or whose prostate or vesicles are palpably enlarged and tender and contain pus, must be regarded as still infected, although the gonococcus is not demonstrable, and further treatment advocated.

The gonococcus serological test may aid in certain cases—especially with complications. A positive test is regarded as specific. The great handicap of the test is in securing a good antigen. We have found an antigen made from polyvalent strains, the more the better, gives the most satisfactory results.

As the rule is that most cases of anterior urethritis become posterior, so it is that a large percentage develop some complication, which may lead to some serious disorder. The most common are balanitis, phimosis and paraphimosis, lymphangitis and lymphadenitis, folliculitis and periurethral abscess, cowperitis, prostatitis, seminal vesiculitis, epididymitis, cystitis, urethritis, pyelitis, conjunctivitis, exostoses, arthritis, and endocarditis. A consideration of the most important will be taken up.

Active gonorrhea is not accorded serious consideration by the patient except mentally. The view that it is no more than a cold is being rejected by the laity due to public instruction, and practitioners are beginning to realize the extent of pathology it may incur. Various estimations of its prevalence have been made and it is difficult to arrive at definite conclusions, but it is accepted that the majority of the adult male population (ninety per cent.) has or has had the infection. The prevalence in females is even more difficult to estimate. Although there is a mortality from gonorrhea, as evidenced by such complications as cystitis, pyelitis, pyelonephritis, stricture, pleurisy, endocarditis and myocarditis, the morbidity is the more important consideration in view of other complications as prostatitis, spermatoecystitis, epididymitis, conjunctivitis, iritis, cyclitis, synovitis, arthritis, "rheumatism," neuralgic pains and such mental disorders as neurasthenia and melancholia. That many of these distressing complications do not occur or cause a high morbidity, one has only to view the male population at large. Stricture is the commonest serious sequel of gonorrhea. Prostatitis and spermatoecystitis are the

commonest complications, and the most frequently overlooked urogenital focus of sepsis, providing an explanation for many remote symptoms too little appreciated by the average practitioner of medicine.

Gonorrheal arthritis is a serious complication affecting a large joint or joints and may produce ankylosis and crippling for life. The knee, ankle, wrist and elbow are the joints commonly involved.

Gonorrheal epididymitis is the cause of sterility in a large percentage of males, and salpingitis and oöphoritis play the same rôle in the female, or may produce what is known as "one child sterility."

Most authorities agree that seventy-five per cent. or more of the abdominal operations performed on women are to relieve pathology caused by the gonococcus. Salpingo-oöphoritis may make a woman a chronic invalid for life, and a common opinion among gynecologists is "once infected always infected."

Gonorrhea and its complications play a notorious rôle in matrimonial estrangements, etc., and frequently figure in divorce proceedings.

That a large percentage of blindness due to gonorrhea may be prevented has prompted the legislature to make it a misdemeanor for the attending obstetrician to fail to carry out the prophylactic treatment for gonorrheal neonatorum.

As it is questionable whether the vaginitis in children is ever cured, it is possible for the infection to remain dormant and then become active later in life.

Stricture. Stricture is considered one of the sequelæ of urethritis. The congenital variety is confined mostly to the meatus, and as this portion of the urethra is the least dilatable, they are cured by meatotomy.

Acquired stricture is classified:

- (1) Inflammatory (really belongs to organic).
- (2) Spasmodic.
- (3) Organic, (a) large caliber, (b) small caliber.

The inflammatory type are due to acute urethritis, and the treatment should be directed to relieve this condition.

The spasmodic type is due to a reflex muscular spasm from some irritation, either inside or outside the urinary tract, *i.e.*,

small meatus, posterior urethritis, concentrated urine or operations on anus and rectum. It is common following surgical operations and soon passes away. In certain individuals it is difficult to pass any urethral instrument until this spasm is overcome by steady pressure.

The organic type is the most common and most frequently is due to gonorrhea. Urethritis due to injection of strong corrosives may persist for years and lead to stricture. Trauma is a not uncommon cause, *e.g.*, rupture of urethra.

Males between twenty and forty-five years are mostly affected, although it is also seen in women. Stricture rarely develops within one year of the infection and it may take longer for the infiltration to undergo organization. Guyon holds that the greatest number of strictures occur four to ten years from the beginning of the original urethritis.

Clinically strictures are classified: (1) soft or recent, (2) cicatricial; again as (1) simple, (2) irritable and (3) resilient or recurring.

A stricture which will not permit the passage of a No. 15 F. instrument is regarded as small caliber, and those that will, as large caliber.

The large majority of gonorrheal strictures are located at the bulbo-membranous juncture of the urethra; next, the first few inches of the penile urethra. The prostatic urethra is rarely, if ever, affected.

The stricture causes changes in the urethra posterior to it. There is congestion, thinning and dilation of the walls. As it progresses the mucous membrane becomes more altered and erosion of the surface occurs. Ulceration follows and may lead to extravasation of urine with suppuration. Fistulæ are often formed. Gonorrheal strictures are often multiple, while traumatic strictures are usually single. Their dilatability and elasticity vary inversely with their consistence.

In a case presenting a stricture, there is usually a history of urethral infection of long duration and changes in the urinary stream. Frequency is often noticed first, followed by changes in character of the stream and lessened power up to actual dribbling. Retention of urine is frequent and may be chronic or acute. The chronic form may have incontinence associated with infection of the urine, ardor urinæ is present and often

vesical tenesmus. Constitutional symptoms depend upon retention, infection or extravasation and may even lead to uremia or septicemia.

The diagnosis is made by the obstruction to the passage of urethral instruments and its size and position noted. "Gentleness, patience, perseverance and copious lubrication are the corner stones of successful urethral instrumentations," and strict adherence to and skill in the application of this dictum has obviated many a urethrotomy. "Dilate if you can and cut if you have to," is the golden rule in the treatment of stricture. In most cases, even with complete retention, with a liberal application of the above principles it will be possible to pass some instrument into the bladder and probably dilate later and save the patient an immediate operation. A most useful instrument in the strictures of small caliber is the Phillip's catheter, which consists of a woven filiform, the end of which is fitted with a thread into which may be screwed a catheter which is passed into the urethra and with the filiform as a guide ahead, enters the bladder, the filiform coiling up and removed later with the catheter. Strictures of small caliber are distinctly bed cases for a hospital. Having successfully passed a catheter into the bladder, it is tied in and removed in forty-eight hours.

Most strictures are dilatable and cutting operations are being done increasingly less frequently. An impermeable stricture is treated by an external urethrotomy or combined with internal urethrotomy. Resilient, recurring, fibrous, traumatic and those strictures complicated by fistula usually require a urethrotomy, either internal or external. An attempt should be made to dilate all other strictures, as the results are better with gradual dilatation than operation.

The after-treatment is most important because there is a tendency for strictures to recur and we frequently see it in the dispensary practice, where, in spite of instructions and warning, patients only remain under treatment as long as there are symptoms—disappearing until the next attack of retention with the stricture closed down again. If the stricture is passed without any operation, the catheter is allowed to remain *in situ* for forty-eight hours—in the operative cases, four to five days, after which time it is removed and bougies

in the smaller cases, and sounds in the larger, of the same size as permanent catheter and the next larger are passed with plenty of lubrication. The urethra and bladder are always irrigated before and afterward. A good working rule is to pass only two urethral instruments on one day and dilate twice a week. Regular dilatation is followed out in these cases until the canal reaches the normal size or as far as it is dilatable. The intervals between dilatations are then lengthened, and the patient is kept under observation at regular intervals for several years to insure against a recurrence.

The results of stricture depend upon how early the diagnosis is made. Unrelieved, it produces changes in the urethral walls and pressure to the urinary tract posterior to it. Extravasation of urine may occur, which may be gradual or sudden, and is produced by ulceration of the mucous membrane and abscess formation with leakage of urine, or by the formation of a false passage in the attempt to pass an urethral instrument.

With the gradual form there is pain upon pressure to the tumor which develops, but in the sudden form intense burning or pain is felt at the seat of rupture. The local symptoms are those produced by an irritating fluid being held in the tissues. With infected urine, decomposition sets in promptly with the formation of gas, which produces emphysema. There is marked swelling, the skin becomes discolored and may slough away. The patient is extremely toxic due to the septicemia and unless the condition is relieved, the prognosis is bad and death may occur.

The extravasation of urine depends upon the site of rupture and is governed by the attachment of the fascia, the usual source being from the bulbous and membranous urethra, the urine infiltrating the peritoneum and scrotum and mounting upward upon the belly wall.

The treatment consists upon preventing further extravasation and drainage of the infected areas, and the easiest and quickest way to accomplish this should be carried out, depending upon the condition of the patient. Attempts to relieve the stricture are advised when the patient's condition warrants. Special emphasis is made upon thorough drainage and wash-

ing out as much as possible of the infected urine. Early diagnosis is important.

The bladder is liable to changes if the stricture narrows and the pressure is prolonged. Compensatory hypertrophy takes place together with infection. This cystitis makes the patient's symptoms worse. The back pressure may extend to the ureters and kidneys, producing hydroureter and hydronephrosis by mechanical obstruction. Ascending infection may occur from the bladder, producing a pyelitis or pyelonephritis or pyonephrosis.

Vesical calculi may be produced, associated with urethral calculi. Impotence and sterility may result from stricture. Other pathology may be masked by the presence of a stricture, which can not be diagnosed until the stricture is relieved.

CASE D. K., Male, age 55:

C. C., Hematuria with clots in urine.

P. M. H., Urethritis 20 and 17 years ago. Sounds passed 16 years ago.

H. P. I., First attack of hematuria noticed 4 or 5 years ago, which disappeared in a day. All right for one and one-half years when there was more hematuria, which ceased promptly. Six months ago had several attacks and lately bleeding has been continuous, which was quite marked the last few days. No pain associated with attacks.

Urine was bloody on examination. No T. B. found. Other examinations were negative.

X-ray of urinary tract was negative. Wassermann negative.

No. 10 urethral bougie was passed with some difficulty and a diagnosis of a stricture of small calibre of posterior urethra was made. Regular dilatation was carried out and there was no bleeding for one month, at which time the urethral calibre was 25 F. Hematuria occurred again and upon cystoscopy a papilloma of the bladder was discovered which yielded promptly to electro-coagulation. The papilloma which was causing the hematuria could not be diagnosed until the stricture was dilated sufficiently so that a cystoscope could be passed.

CASE II, Male, age 70:

C. C., Difficulty in micturition and hematuria.

P. M. H., Urethritis 49 years old. Had an attack of retention 20 years ago and had to be catheterized. No treatment since.

H. P. I., First noticed hematuria 4 years ago, which has been intermittent ever since. Burning on micturition associated with frequency. Nocturia 3X. Urinary stream is poor in power most of the time, but starts promptly. Loss of weight.

Examination revealed a stricture of small calibre at the bulbo membranous junction, and a chronic prostatitis and chronic cystitis. When

the stricture was large enough to admit a small size cystoscope, the bleeding was seen to be coming from left ureter and a diagnosis of hypernephroma was made.

Urethral fever is usually produced by the passage of instruments through the urethra, being due to absorption of toxins through abraded areas and therefore more likely to occur in those individuals with infected urine and where the instrumentation has produced some bleeding. Gentleness in handling is as important as asepsis.

The attack is characterized by a paroxysm of a chill, fever and sweat, all of which may be severe, with the temperature rising to 105° or 106° F. The paroxysm may be recurrent, but usually everything has subsided at the end of twenty-four hours and the patient feels normal again. With the recurrent variety the course may run several weeks.

The treatment is mainly prophylactic. Senile patients and those with infection of the urinary tract that require the passage of instruments should be regarded as bed patients, and must be kept in bed until the danger of urethral fever has passed. The administration of a urinary antiseptic several days prior to an examination is advised. The urethral and bladder irrigation preceding and following instrumentation is most important. The patient should be thoroughly protected during the examination. Quinine sulphate, Dover's powder and morphin are regarded as good prophylactic agents. The treatment is mainly symptomatic and assuring the patient that "everything will be all right tomorrow." Fatal outcomes have been reported.

EPIDIDYMITIS.

This occurs as a complication of gonorrhea in five to ten per cent. of cases, and may follow urethritis or cystitis from any cause, especially when associated with prostatic enlargement. The prostate and seminal vesicles become involved and the infection spreads down the vas into the epididymis. The patient is likely to regard some slight trauma as a predisposing cause. In a majority of cases the infection will begin in the tail of the epididymis although this fact is of no special significance.

The pathology is that of acute inflammation, often with the production of an acute hydrocele.

There is acute pain, tenderness and swelling of the involved epididymis and the subcutaneous tissues become swollen and tense. The swelling may reach the size of a clenched fist or larger, and the testicle itself may be masked for palpation by the acute hydrocele formed. The patient notices that the urethral discharge has ceased—only to reappear when the epididymitis begins to subside. The pain may start in the inguinal canal and descend along the cord, and often is severe enough to require an opiate. Fever is present and may be around 103° F. The inflammation reaches its peak in from three to five days, when the condition should begin to subside. The patient usually has to remain in bed.

The diagnosis is sometimes difficult when the swelling is enough to obscure the epididymis from testicle. Orchitis, tuberculous epididymitis, tumors, hydrocele and hematocele must be borne in mind and ruled out. The complement fixation test is a reliable guide but rarely necessary.

The treatment is divided into prophylactic, palliative and operative.

By prophylactic is meant rest for those patients with an acute urethritis, a suspensory, delaying the passage of urethral instruments until the urine has become clear in the gonorrheal cases, or the careful washing out of the urethra before and after in those infected cases that require instrumentation, and the internal administration of an urinary antiseptic.

The palliative treatment consists of absolute rest in bed together with the routine treatment of urethritis cases such as copious amounts of water, restricted diet and free catharsis. The scrotum should be elevated either by a bandage or a broad strip of adhesive between the thighs, and an evaporating lotion such as a saturated solution of magnesium sulphate applied. Urinary antiseptics are administered by mouth and no local treatment given. The condition should begin to subside in from three to five days and is evidenced by lessening of pain, diminution in size, being less hard on palpation, temperature returning to normal and reappearance of discharge.

The operative indications, which are regarded as clear cut and self-explanatory, are as follows:

1. Cases that do not subside promptly—or seem to grow worse.

2. For the relief of pain—the administration of an opiate is looked upon by many as sufficient indication.

3. Recurrent cases.

4. Bilateral cases.

5. Better prevention against sterility.

6. The operative procedure usually gets the patient around quicker and is therefore indicated as a war-time measure. Local treatment and prostatic massage can be started promptly so that, theoretically, the duration of the disease is thereby shortened.

For these reasons epididymotomy, the operation usually performed, is being employed more and more by some operators.

The prognosis is regarded as good.

Sterility may follow and the patient usually retains a small hard nodule in the epididymis as a souvenir of the attack (not as likely with operation).

Local treatment for the urethritis cannot be resumed until the epididymitis has completely subsided.

Epididymo-orchitis seen complicating the acute infectious diseases such as mumps, typhoid, variola, etc., should not be confused with acute epididymitis. The seat of the inflammation is primarily in the testicle and is hematogenous in origin. Hydrocele may develop, but is less common than is epididymitis. Children are mostly affected and the other evidences of a general infection are present.

Palliative treatment is the general rule and sterility is common, due to atrophy of the testis.

SEMINAL VESICULITIS OR SPERMATOCYSTITIS.

In a majority of cases of gonorrheal urethritis, the infection extends into the seminal vesicles.

As the symptoms produced by a seminal vesiculitis simulate those of posterior urethritis, but are deeper seated, cause more referred pain and are more likely to produce constitutional phenomena, the condition is often overlooked. Pains may be noted in perineum and about anus, made worse by defecation. Frequency of micturition is produced. There may be constitutional symptoms with fever. Occasionally it develops insidiously and is only found by examination.

The normal vesicle is not palpable to the finger on rectal palpation and the presence of a tender and fluctuating mass passing up and outward from the prostate is sufficient to make the diagnosis. The condition may be bilateral and is often associated with a prostatitis.

Palliative treatment is indicated until the acute symptoms subside when massage and irrigation are begun. If the condition goes on to abscess, open operation must be resorted to.

The chronic form is the type usually seen and it may be the focus of infection for some general condition. The treatment is mainly by massage and the record of improvement is noted by examination of the secretions expressed from urethra and examined under the high power objective. Seminal vesiculitis is quite refractive to treatment and when no further progress can be noted by regular massage, vaso-puncture and medication of the seminal vesicles with some silver salt such as collargol has been recommended. Analysis has shown that by such procedure forty per cent. of patients have been cured, at least symptomatically, and over fifty per cent. improved.

Seminal vesiculomotomy has not been followed by the permanent benefit, so far as pain and "rheumatism" are concerned, as the immediate results at first indicated.

The employment of bacterins either autogenous or stock has been of value in certain cases.

The seminal vesicles, the analogues of the Fallopian tubes, when once infected, like the pus tubes in the female, remain probably always infected to a greater or less degree.

PROSTATE.

In its developed form it is a genital organ made up of glandular tissue with considerable admixture of smooth muscular fibers and connective tissue, with the glandular tissue preponderant in the lateral lobes. It varies greatly in size. In children it is rudimental, at puberty it grows rapidly, attaining full development about the twenty-fifth year; at the fiftieth year there is further increase in size due to hyperplasia of glandular elements, the muscular tissue showing rather a tendency to atrophy. The average measurements are given: length 3.2 cm.; width 4.1 cm. and thickness of 1.3 cm. The

shape is that of a chestnut and it surrounds the first part of the urethra.

The prostate contributes to the semen a thin, opalescent, albuminous fluid, containing lecithin bodies, a few epithelial cells, amyloid bodies and a few leucocytes. The purpose of this fluid is to give the semen greater volume and to render the spermatazoa more mobile and viable for a greater length of time within the female genitalia.

The prostate discharges its secretion during intercourse and possibly, together with the perineal muscles, helps in voiding the last few drops of urine from the prostatic urethra.

It is believed by some that the prostate has an internal secretion.

The nerve supply is rich, so that the condition of the prostate exerts a powerful influence on other structures and organs, particularly those of the genital system. It is not unusual for infection of the prostate to exert a more powerful influence on the mental and general nervous condition of the individual than an infection of like grade in some other organ.

PROSTATITIS.

This may be acute or chronic. The common predisposing cause is congestion and the infection is either an extension of a gonorrheal urethritis (the most common) or is carried in by instrumentation, or may be hematogenous in origin. Certain individuals who present a prostatitis with the statement of never any venereal infection must be regarded as telling the truth. One author goes so far as describing frequent attacks of tonsillitis as a possible cause. Contiguity of structure may account for a small percentage.

In *acute prostatitis*, there is an increased vascularity with a marked dilatation of the prostatic plexus of veins. The inflammation beginning along the mucous membrane of the urethra, extends into the ducts of the glands and where these become occluded forms suppurating retention cysts through the parenchyma of the organ. Abscesses may appear in the form of small multiple foci or as large collections. As the inflammatory secretion increases in quantity, the glandular capsule may rupture and several suppurating glands becoming confluent, forming large accumulations. Periprostatitis may

result from rupture of pus through the capsule or transmission through blood-vessels or lymphatics.

The infiltration may undergo resolution or may suppurate, most commonly in the posterior surface of the gland.

Pain is usually the chief symptom, which is located in the perineum and made worse by defecation. There may be the sensation of a foreign body in the rectum. There is frequency of urination and should the swelling of the gland be marked, difficulty of urination is encountered, up to complete retention. General symptoms with fever develop. Rectal palpation reveals an enlarged and tender prostate, which may fluctuate. The swelling may be as large as an orange.

Palliative treatment is reserved for those cases which have not yet gone on to pus formation and have no difficulty in urination. Absolute rest in bed, with the usual routine for urethritis, is essential. Opium and belladonna suppositories are indicated for pain. Antipyrin and laudanum in a small quantity of water instilled in rectum is distinctly advantageous in some cases. Hot and cold rectal douches furnish symptomatic relief in many cases.

Should suppuration occur with the formation of fever, a matter difficult of determination in many cases, operation is indicated. The best rule is to operate, if in doubt. There seems to be a division of thought in regard to radical operation for prostatic abscess. There are those who believe the best results are obtained by palliative procedures, either permitting the abscess to rupture into the urethra, if it will, or better the passage of an instrument such as a sound and directing the point into the fluctuating mass, allowing it to flow into the urethra after puncture. We believe in the radical operation, consisting of a perineal prostatotomy, as soon as the diagnosis of abscess is made. The untoward results of rupturing into the rectum or bladder are thereby avoided and the abscess is opened and drained under actual vision. The prostatotomy may be carried out either by opening the urethra or not. The after-results are good although the patient has to continue massage, etc., for some time afterward.

The prognosis of prostatic abscess is usually good if handled according to good surgical principles. Most often some of the smaller suppurating areas are left behind and these resolve

into chronic prostatitis. The formation of calculi has been noted after prostatic abscess. The opening of an abscess into the recto-vesical space is usually attended with the formation of multiple fistulæ, which are difficult to cure. In an analysis of sixty-seven cases, twenty-one opened both into the rectum and urethra. Phlebitis is common when the abscess is not properly drained. It is estimated that forty per cent. of the deaths from prostatitis are due to this cause.

Chronic prostatitis usually follows acute prostatitis or may develop from a posterior urethritis of any origin without evidence of acute onset. A majority of cases of gonorrhea therefore develop an infection in the prostate or seminal vesicles or both. As in the acute type, infection is the exciting cause and congestion, due to ungratified sexual excitement, excessive coitus, etc., is predisposing. Anything that irritates or provokes a posterior urethritis, such as concentrated urine, will affect the prostate.

In an analysis of over 1000 cases, the incidence of prostatitis was found to be approximately 40 per cent. in cases examined after the first infection in spite of the fact that the urine was perfectly clear with no shreds, and 90 per cent. in those cases examined after the second infection or later.

The pathology varies and while the condition is attributed to the gonococcus, it is exceedingly difficult to demonstrate. Secondary infection is nearly always present. There is a catarrhal condition of the prostatic glands with a dilatation of the ducts and acini and thickening of the peri-glandular tissue, or following the acute form miliary abscesses may discharge through openings which give insufficient drainage. A few cases will present a distinct interstitial inflammation, which overshadows the catarrhal element, so that secretions expressed may not be far from normal.

The symptoms of chronic prostatitis are varied and may be divided into:

- (1) Genital.
- (2) Urinary.
- (3) General.

(1) As chronic posterior urethritis is associated with chronic prostatitis, there is a state of hyperirritability of the sexual

centers. Premature ejaculations, imperfect or feeble erections, frequent emissions and impotence are often seen.

(2) Frequency of urination is the main symptom, with some association of pain, which may be at meatus or deep in the perineum. There is an occasional discharge from the urethra, which is usually characterized as the "morning drop." It may not be much, perhaps only the sticking together of the meatus. The infected secretions of the prostate being poured out into the urethra, keep up an infective posterior urethritis and further the production of shreds.

(3) General symptoms are often present and depend upon absorption of toxic materials from the prostate. The prostate therefore may be the focus of infection of any general infection, such as an arthritis. There are those patients who have symptoms referable to the urinary tract, such as frequency, etc., which lead to a direct examination and discovery of the source of infection, but the symptoms in others do not point to the prostate at all, and the focus may be overlooked except when found in the course of a routine examination. Patients with a chronic prostatitis often present the picture of fatigue and general debility, and it is surprising to notice the beneficial results from regular prostatic massage, as it seems to restore their bodily vigor and give a new lease on life.

Neurasthenia, hypochondriac and sexual neurasthenia are not uncommon.

The diagnosis is made by a routine urinary examination, which will often reveal the presence of shreds indicating a posterior urethritis. Rectal palpation will reveal a prostate that is more or less enlarged, boggy and tender. As a result of periprostatic inflammation, the borders of the gland may be hard to define, and it may seem to extend further upward and outward than normal. Nodules are often formed in the gland. After massaging the prostate, the secretions expressed from the urethra at the meatus are examined under the high power objective of the microscope. This is a better indication of the condition than having the patient retain a portion of urine and urinate after massage, which is then centrifuged and examined under the microscope.

The normal prostatic secretion is an opalescent fluid, faintly alkaline in reaction and contains lecithin bodies, amyloid bodies

and a few leucocytes. Vesicular secretion may be expressed at the same time and spermatozoa are often seen. The prostatic fluid that does not have an excess of five leucocytes to the one-sixth high power field is regarded as normal, in excess of this is regarded as catarrhal inflammation. One examination of the prostate in an individual is often not enough and we have observed in the routine treatment of cases of urethritis, that the prostatic secretions upon first examination would be normal, while at a second examination a week later evidences of inflammation would be found.

The treatment follows that indicated for any infection of the urinary tract. The diet is regulated, free catharsis is encouraged, and the patient is urged to drink large amounts of water. The urine is rendered bland with a urinary antiseptic, although in the late stages of chronic prostatitis, little medication except water is needed. Exercise is restricted.

The patient must be impressed that the cure of prostatitis is a slow and tedious process at best, and that regular and persistent treatment with careful carrying out of instructions offers the only hope of recovery. Sexual excitement should be avoided, although in the later stages, sexual relation, with the physiological emptying of the prostate and vesicles, is probably a good therapeutic measure provided it is not carried out too often or too much.

Regular treatment for the posterior urethritis should be carried out by means of total irrigations. When the acute symptoms have subsided prostatic massage is begun. The patient is instructed to stand with his feet apart and heels out, and, bending over with the knees straight, place the elbows on the chair or stool in front of him. The finger protected by a glove or finger cot is well lubricated and, after the outline of the gland has been ascertained, massage is begun from the outside toward the median line, on both sides, followed by a general stripping of gland downward. The movements should be slow and firm taking care not to exert too much pressure. The amount of pressure to use in massage is a matter of experience. We have seen patients made worse and complications produced by following too vigorous massage. It is apt to stir up infection—an acute urethritis, prostatitis—even going on to abscess formation. While the text-books say the patient should

have prostatic massage and the massage is given—it is most important that the treatment be carried out with the greatest amount of skill and attention, otherwise the time, labor and money avail naught and may be fraught with danger. The practice during the war of turning massage over to inexperienced orderlies accounts in some measure for the great number of non-cured chronic cases among the soldiers and sailors.

In most cases after massage, the secretions may be caught on a glass slide at the meatus. With much catarrhal inflammation the secretions literally run out, while in the interstitial type it may be difficult to get a drop. The examinations should be recorded and may possess some prognostic value, when compared month by month. At certain times a single examination of the secretion may show a normal count and then a few days later may contain so much pus that the leucocytes are too numerous to count. A possible explanation of this may be that a small pocket was opened up and expressed out the second time that was missed the previous massage, or the first examination may have followed too soon after an emission or ejaculation.

Massage should be carried out at regular intervals and should not be done oftener than twice a week or every five days. The symptoms incident to the massage should have disappeared before the next treatment is given. The method of giving the massage may be either on a full bladder or a half emptied bladder. After the massage the patient voids the remaining urine in the bladder and then a total irrigation with some weak antiseptic solution, as nitrate of silver or potassium permanganate, is given; for the reason that some of the infected material is very apt to run back into the bladder, and this should be washed out in order to minimize the liability to cystitis.

The massage is carried out at regular intervals until the gland feels normal to palpation and the examination of the secretion does not show an excessive number of leucocytes. when the patient is allowed a longer interval, which is gradually increased until he is discharged. In a certain percentage, which is quite high, the count may never reach normal and should it not exceed ten to fifteen leucocytes per high power

field, we usually feel satisfied, providing that in the intervals between treatments this number does not increase. In other cases after regular treatment for say a year the drop is still loaded with pus—it is better to give these individuals monthly treatment, providing they are free from all subjective symptoms. Most writers declare that a period of rest for the chronic cases with no treatment is an excellent thing and greatly benefits the condition. Certain it is, however, that an infection left in the prostate, even if slight, is apt to linger there even though producing no subjective symptoms, indicating that nature evidently is unable to eradicate it.

The passage of urethral instruments is a great help and after the normal size sounds can be taken, the over dilatation of the posterior urethra with the Kollmann dilator is of benefit.

Bacterins, both autogenous and stock, prove beneficial in certain cases, while in others no apparent help is noticed. The scientific procedure is the autogenous bacterin, but often the facilities are not present and the obstacles in the path of culturing the gonococcus are many.

Prognosis is difficult to state and depends upon many variable factors. When patients inquire the length of time to effect a cure, the answer of anywhere from three months to three years expresses it as tersely as possible. Certain patients respond quickly to treatment, and are probably of the mild catarrhal variety, but others that have had a history of an abscess seem to hang on indefinitely.

As true prostatic hypertrophy is rarely seen under the age of fifty years, it will not be discussed. Moreover, gonorrhea as a cause of prostatic hypertrophy is a delusion.

BLADDER.

The individual bladder capacity varies greatly, but normally distended it should hold from twelve to sixteen fluidounces of urine, and when in a healthy condition may hold twice that amount without any damage. In acute obstruction pain begins fairly early, so that the bladder does not become greatly over distended, but in chronic obstruction with a gradual increase of intra-vesical tension, the bladder may hold over a

gallon. Due caution is always advised against the complete removal of urine from a chronically distended bladder, as it tends to produce shock, and death has resulted. The urine should be removed gradually, taking twenty-four hours to empty the bladder.

Hypertrophy of the bladder is an over development of the muscular tissue, and may be associated with thickening of the mucosa. The cause is obstruction to the flow of urine from the bladder, producing a compensatory hypertrophy. In obstruction at the vesical neck, there is often dilatation of the bladder in association with hypertrophy, the weaker portions of the wall yielding between the muscular fibers and is known as tubercular hypertrophy. This is very common, especially with prostatic hypertrophy, and infection is usually present producing a cystitis.

The diagnosis is made with the cystoscope and the treatment directed to relieving the obstruction. If this can be accomplished before degenerative changes take place in the bladder walls, the prognosis is good.

While *atony of the bladder* is almost physiological in individuals beyond middle life, yet it occasionally occurs before. It is due to over distention which may be acute or chronic. The hypertrophied bladder usually becomes atonic as do those cases with prolonged drainage. The walls become thin and pouch like and the capacity is increased by distention.

The diagnosis is based on the history and the ruling out of other factors. Residual urine is present up to complete retention. Frequency of urination with no power is a common symptom. In case the residual urine exceeds ten ounces, the prognosis should always be guarded.

The treatment consists in removing the cause and relieving the subjective symptoms, such as cystitis. The patient is instructed in good hygiene and a good tonic advised. Increasing doses of strychnin sulphate up to $\frac{1}{10}$ grain has given excellent results in a small series of cases that we have observed. The following case history is typical and very instructive because the patient has been admitted to the hospital on three different occasions with complete retention and cleared up completely on the administration of strychnin in ascending doses.

CASE I. R., Male, age 63 years.

C. C., Retention of urine with incontinence.

P. M. H., Urethritis many years ago.

H. P. I., One month previous had an attack of sinusitis and about one week ago found he was suddenly unable to void urine, requiring catheterization.

Physical examination was negative except for a generalized arteriosclerosis with a marked annulus senilis.

B. P., S—125, D—75.

Urine: Negative. No urethral stricture. Cystoscopy reveals a trabeculated hypertrophy of bladder with some congestion at apex of trigone. Indigocarmine intramuscularly appeared from both urethral orifices in 7 mins. Quantitatively first hour, 12 per cent.; second hour, 10 per cent.; third hour, 1 per cent. Total, 23 per cent.

Wassermann: Negative. G. S. T., negative. Spinal fluid Wassermann negative.

There was no organic lesion of the central nervous system. The patient was catheterized at regular intervals and placed on ascending doses of strychnin. After five weeks he was able to completely empty the bladder and was discharged.

Three years later, he had a similar attack which cleared up in three weeks, so that he had no residual.

Again, three years later, he was admitted to the hospital with a similar attack, which cleared up as before.

Diverticulum and Diverticulitis. Diverticula are described as being congenital and acquired, although recent experimental work on embryos tends to the opinion that they are all congenital, but no symptoms are produced leading to their discovery until some obstruction to the outflow of urine causes a hypertrophy of the bladder and the infection sets up a cystitis and diverticulitis.

Diverticula may be any size from a mere bud to a larger capacity than the bladder itself. Frequency of micturition and pain are common. There is often a sense that the bladder is not completely evacuated and that after micturition, more urine can be voided. Infection is always present and the urine may be very foul and hard to clear up. Complete retention is common. In fact, it may be briefly said that a diverticulum of the bladder may produce all the symptoms of prostatism without the prostate. Formation of vesical calculi is frequent.

The diagnosis can be made with the cystoscope and a cystogram made by injection of some opaque medium, as 5 per cent. silver iodide, into the bladder and then x-rayed in

several positions. The cystogram will reveal the size and extent of the diverticulum.

The treatment consists in removing the obstruction and attention to the cystitis. When this is cleared up it must be decided whether the diverticulum can be removed by surgical intervention. If so, it is usually advised.

CASE M., Male, age 22.

C. C., Difficulty in micturition.

P. M. H., Denies venereal infection.

H. P. I., Patient has always had a small and slow urinary stream, but this was attributed to a very tight foreskin, which could not be retracted. Circumcision was done under ether 5 years ago and a sound was passed into the bladder without any difficulty. At times he has noticed a swelling in the supra-pubic region which does not go away when he urinates and is worse in cold weather. At times there are attacks of frequency, but little burning. No loss of weight.

There were marked varicose veins in the legs, especially on the left. No adenopathy. Knee jerks are ++. No Romberg. Irides react to light. Left inguinal hernia.

Prostate was slightly enlarged, boggy and tender and the examination of the drop revealed an average of 40 W. B. C. to $\frac{1}{6}$ F. indicating a chronic prostatitis.

A catheter passed easily and 6 fluid ounces of residual urine obtained, which showed pus upon examination. Chromoureteroscopy revealed a bladder which is markedly enlarged and trabeculated. The openings of many small diverticula are seen. The bladder is enlarged upward with a ring of constriction at what is apparently the normal limit of the bladder. Indigocarmine, given intravenously appeared from the left side in 5 mins. and not from the right side within 10 mins. A cystogram with 5 per cent. silver iodide revealed many small diverticula and a large one, superimposed on the bladder like a figure eight. The first and second sacral vertebræ were not closed.

This case presented many diverticula, which were secondary to the deficient nerve supply of the bladder and were not considered amenable to surgical procedure for that reason.

Rupture of the Bladder. This may be either intra- or extraperitoneal and is usually due to direct violence. The so-called idiopathic rupture follows some degenerative lesion of the bladder. Distention is the predisposing cause, as is alcoholism, which will permit the distention to occur.

The intraperitoneal rupture is more common, although in association with fracture of the pelvis the extraperitoneal is more frequent. There is a sharp sense of pain or possibly giving away, and a constant desire to urinate with no urine or

possibly a few drops of blood. The patient is shocked. Tenderness develops in the hypogastric region with tenesmus. The passing of a catheter and obtaining no urine or blood, or the failure to obtain the return of a measured amount of infected blood, or the employment of the cystoscope make the diagnosis.

When the diagnosis is established, operation is indicated with suture of the bladder. Unrelieved it leads to fatal outcome and death occurs in a few days from pelvic cellulitis, peritonitis and toxemia.

Vesical fistulæ are usually caused by the failure of a surgical or gun-shot wound to heal or by erosion, parturition, calculus, abscess, or malignant or tuberculous infiltration.

They are always associated with a cystitis and are characterized by the dribbling of all or a portion of the urine. With infected urine, the skin opening of the fistula becomes excoriated. Usually there is little difficulty in the diagnosis and the injecting of a dye into the bladder or the cystoscope will clear up any doubtful case.

In the cases caused by tuberculous or malignant infiltration, the prognosis is bad and the treatment is directed toward the cystitis. Generally speaking, if there is no obstruction to the urinary flow, the fistula will close as soon as the inflammation subsides. This may be aided by suprapubic or perineal drainage. Those persisting should be excised when possible after the cystitis has cleared up.

Inflammation of the Bladder or Cystitis. This may be catarrhal, interstitial or pericystic. The predisposing causes are congestion and retention. The congestion of the bladder may be produced by retention of urine; trauma incident to instrumentation; frequent muscular contractions as in polyuria; abnormalities in the urine as phosphoruria; presence of tumors or calculi; prolonged sexual excitement; lesions of central nervous system destroying vasomotor control and producing retention; and the exposure to cold. The infection may be from a variety of organisms and reach the bladder either through the urethra, descend from the kidneys, from the blood or lymph channels, or by contiguity.

The colon bacillus is the most frequent infecting organism.

Pain is present in cystitis and is felt in the bladder region, in the perineum and at the end of the penis. It is made worse by micturition, and is less when the bladder is empty. It may be associated with intense burning, frequency and tenesmus. There is frequency of micturition, caused by the tension on the bladder mucosa, which is acutely inflamed, and the hyper-sensitive posterior urethra, resulting in the desire to get rid of the irritating pressure of the urine. This is worse when the patient is on his feet. The frequency may be so marked that the patient has to void every ten to fifteen minutes.

Pus is found in the urine and varies considerably in amount. In the very acute stages some blood may be present and there is always bladder mucus and epithelial cells. With the decomposition of urine in the bladder there is found a thick rope of muco-pus which is very tenacious. The amount of pus in the urine should be controlled by frequent microscopic examinations.

Constitutional symptoms of fever, chills, etc., are frequently observed.

The diagnosis is easy and should be made promptly.

The treatment is prophylactic and curative. Careful asepsis in the examination and instrumentation of all cases should be rigidly carried out. As congestion is a predisposing cause, anything that is liable to lead to congestion is eliminated if possible. The urine is rendered as bland as possible by a urinary antiseptic and should it show high acidity or alkalinity, this is corrected. Diet is restricted and the acids and spices are to be avoided, along with the alcoholic beverages. Patients do better under rest in bed than anything else. Free catharsis is important.

A careful search is made to determine the cause of the cystitis and remove it. Should there be obstruction to the urinary outflow, a permanent catheter or cystotomy for drainage is essential in patients with prostatic hypertrophy; if the obstruction be due to a stricture, this must be treated primarily. If there is a descending infection from the kidneys, this must be removed. Bladder irrigations of potassium permanganate or silver nitrate are carried out once or twice a day in chronic cases. It is better to irrigate through the urethra

in those cases where there is no residual urine, the catheter being employed where the patient cannot empty his bladder completely. Instillations do good in some cases.

Urinary antiseptics are administered by mouth, of which salol and hexamethylenamin are the most useful. The latter is efficient only when the urine is strongly acid and in doses of 30 grains a day. The ingestion of large quantities of water should be insisted upon.

Autogenous bacterins have been beneficial in some chronic cases.

Should the patient not respond to treatment but become more toxic, cystotomy for better drainage is indicated and should be carried out without delay; and may be done under local anesthesia, with but little discomfort.

The tendency for most cases of acute cystitis is to become chronic and may run on indefinitely. With no complication, the prognosis is good, but where the exciting cause can not be removed, the course depends upon the cause. With the presence of a cystitis, there is always the possibility that the infection may ascend into the kidneys. Too often the cystitis is allowed to go on with only a urinary antiseptic in the hope that it will clear up. Then, too, symptoms only may be treated and a cystitis may be caused by descending infection and unless this is recognized and removed, little will be accomplished. Accurate and early diagnosis in middle age, will do a great deal to prevent the chronic cystitis of old age.

URETERS.

The average length of the ureters is from twenty-seven to thirty-five centimeters. The average diameter is about three or four millimeters but the caliber is not the same throughout, being constricted slightly (1) at the junction of the ureter and the pelvis of the kidney, (2) at the crossing of the iliac artery at its bifurcation, and (3) at the entrance into the bladder, which is probably the smallest diameter, and (4) at the vesical orifice. When there is chronic obstruction to the urethral flow, the ureters dilate above the obstruction and may reach considerable size.

Inflammation of the ureters produces a ureteritis and may be caused by a descending infection from the kidney, an ascend-

ing infection from the bladder or by contiguity of tissue, as from an appendiceal abscess. If the inflammation extends beyond the mucous membrane involving the muscular coats, there may be a resulting atrophy, with loss of peristaltic power. Strictures may form from long standing inflammation.

As ureteritis is nearly always associated with a pyelitis or cystitis, there are no definite symptoms. There may be pain directed down the course of the ureter and into the bladder or testicle.

The treatment is directed to the disease and focus which is causing the ureteritis.

Ureteral strictures are congenital or acquired of which the congenital is the most common, with the constriction in the upper portion.

The symptoms produced are those of back pressure and should there be obliteration of the lumen, the kidney will atrophy. Partial occlusion causes hydronephrosis and dilatation of the ureter above the point of stricture.

The symptoms are those of hydronephrosis and obstruction to the passage of the ureteral catheter. Distention of the ureter with an opaque medium and x-ray are valuable. Cystoscopy may reveal an absence of the usual peristaltic swirl of urine and a delayed renal function on the affected side, some obstruction to the ureteral catheter and after passing through the obstruction, a constant flow of urine.

Dilatation is employed on those strictures which will permit the passage of the ureteral bougie, in either the intermittent or continuous form. With the latter, the catheter is left *in situ* for twenty-four hours or more.

The impermeable strictures require operation which may consist of ureteroplasty, excision and end to end anastomosis, uretero-ureterostomy or transplantation on removal of the kidney.

The prognosis in the permeable cases is good, if there is no kidney damage. It is guarded in the impermeable cases and where renal damage has occurred, strictures of the lower ureter respond better than those higher up. An early diagnosis of the true condition before kidney damage results, is the keynote of the success to the patient.

KIDNEY.

Infection is carried to the kidney from below via the ureters or lymphatics, by the blood stream systemically or by contiguity. Ascending infection is preponderant and is the most important in this discussion. Hematogenous infection is always secondary to an infection elsewhere in the body. The commonest infecting organism is the colon bacillus followed by other members of the pyogenic group. Pyelitis is not uncommon in the various infectious diseases and should be borne in mind as a possible complication, but is usually mild in character and subsides under palliative treatment.

Renal infection occurs at any age, but certain pathology, which is prone to develop in middle life, tending to obstruct the outflow of urine in either the ureter, bladder or urethra predisposes. Traumatism, unless as a penetrating wound, is not a cause *per se* but lowers the local resistance to infection. Much discussion has arisen as to the route of ascending infection reaching the kidney, but the evidence of experimental work points to the paraureteral lymphatics. Healthy mucous membrane of the urinary tract is usually resistant to infection, but the resistance may be lowered by chronic obstruction, congestion, etc. It has been claimed that infection may reach the kidney without any break in the continuity.

Pyelitis. Inflammation of the kidney pelvis is caused by cystitis, especially with obstruction, or it may be secondary to the infectious diseases and as a complication of child birth. It is commonly bilateral and varies in degree from a superficial catarrhal inflammation to a deeply infiltrating destructive process. When pus blocks the ureter and causes obstruction, pyonephrosis or pyelonephritis develops.

As pyelitis may be either acute or chronic, the symptoms vary considerably and it may develop insidiously, as in the infectious fevers and not be recognized until pus is discovered in the urine.

Usually there is pain in the lumbar region, which in the acute cases becomes severe, with radiation down the course of the ureter. The kidneys are tender upon pressure, but usually not palpable. There is frequency of micturition with pus found in the urine and occasionally blood. The urinary out-

put is decreased with rarely reflex anuria. Constitutional symptoms are present in the acute type, with chills, fever and toxemia.

The diagnosis is made by the cystoscope with observation of purulent urine coming from the ureters, or by microscopical and bacteriological examination of the catheterized urine from the ureters. The determination as to the cause of the infection is by no means so easy.

Pyelitis of pregnancy develops not infrequently early in the pregnancy—about the fourth month in the majority of cases, and the enlarged uterus predisposes to it. The right kidney is usually the one attacked and the condition is unilateral.

Premature labor occurs in about twenty-five per cent. of untreated cases when the attack occurs early in the pregnancy and subsides, the puerperium is likely to be afebrile, but if the attack occurs late in the pregnancy, there is usually fever in the puerperium, but puerperal infection is not common.

The fetal mortality is high in the cases of interrupted gestation. With the attack occurring late in the pregnancy and going to full term, the child is usually healthy and well nourished.

Operative treatment is rarely necessary. With nephrectomy the mortality is about nine and five-tenths per cent.—being well borne prior to the fifth month, but less so after that time.

Medical or palliative treatment is usually given and is especially successful in the cases complicating the infectious fevers. When the condition does not ameliorate, it becomes surgical. Obviously, as a large percentage is due to ascending infection, prophylaxis in examination with asepsis should be carefully practiced. The infection is prone to develop after minor trauma with obstruction below. Rest in bed with restricted diet, plenty of water and urinary antiseptics are essential. If there be any obstruction to the urinary outflow, this should be relieved, a permanent catheter being indicated in many cases and treatment directed to the existing cystitis including total bladder irrigation. Pelvic lavage after catheterization should be considered for those cases which do not clear up. Silver nitrate, in strength from 1:5000 to 1:500, has been advocated.

Culture of the catheterized urine from the ureter is resorted to and the infecting organism isolated, and often the employment of an autogenous bacterin gives excellent results.

Pyelitis caused by a lesion in the kidney or pelvis, such as a calculus, is only relieved by surgery. Those cases which progressively grow worse with pelvic lavage are treated more radically with pyelotomy or nephrotomy.

The cases of chronic pyelitis with the vague and persistent symptoms are the type most important to this discussion, as the other types clear up one way or another. It is very difficult to know what to do with an individual who has an attack of pyelitis, which clears up with the cause not being discovered, only to reappear again. With the infection persisting there is a focus of infection for constitutional disease as well as a portal of entry for a more serious infection of the kidney. As a general rule conservatism is best, especially in the bilateral cases. There is a case in the hospital at present, who has been studied for a long time with no definite opinion as to etiology decided as yet.

CASE I. Z., Male, age 24 years.

Five years ago noticed pain in the back with occasional radiation down the course of the ureters, which has gradually grown worse. There has been pain in the suprapubic region associated with frequency and burning micturition. He had been treated in Russia before coming to this country. He was admitted to the hospital on September 10, 1921. The pain was worse on the right side and the frequency and burning were marked. The pain was dull and constant in character and never colicky. Only slight loss of weight.

There was pus in the urine and many examinations by smears and pigs failed to demonstrate T. B. The bladder showed a chronic inflammation, which was not especially characteristic, but suggestive of T. B. Both kidneys were functionally sufficient to indigocarmine, the function on the right side being delayed slightly as compared to left. Small amount of pus in urine from right ureter and many W. B. C. on left side.

X-ray of urinary tract and pyelography were negative. Other examinations did not point to anything except that after one negative culture of ureteral urine, a staphylococcus was obtained and a bacterin prepared. Several dental abscesses were discovered, the roots extracted and the cavities drained.

He was placed on bladder irrigations and pelvic lavage and bacterin therapy. Shortly afterward the other kidney became involved and then he gradually cleared up, so that he was discharged to the outpatient department. His urine was clear but he still complained of

pain in the back. At present he is in the hospital again with similar symptoms, but the pus has disappeared from his urine. The kidney function is about equal on both sides. It was thought possible his pyelitis could have been a hematogenous affair from his dental abscesses and although he is much improved objectively, subjectively certain symptoms still persist.

Should the ureter become blocked with a plug of pus and mucus, pyonephrosis will develop unless the obstruction is quickly relieved. The pelvis becomes rapidly distended and ulcerations may occur. Infection upon hydronephrosis will produce the same result. If the obstruction is not relieved, the kidney becomes a mass of small abscesses. The obstruction is usually incomplete in a majority of cases. Permanent obstruction to the ureter produces the closed pyonephrosis.

Pain is the first symptom and is colicky in character; and may be accompanied by chills, fever and sweats, and followed by loss of weight, anemia and extreme disability. The swelling produced may be palpable, but is not often perceptible. The patient must have relief immediately and when the ureter is opened, the pain promptly subsides.

The treatment is directed to relieve the obstruction in the ureter and this is performed by the ureteral catheter, which may be left in position for twenty-four hours. This only relieves the immediate attack, and those cases dependent upon mechanical obstruction, can only be cured by surgery. In fact, in the recurrent cases which do not respond to catheterization and lavage, surgery must be resorted to in the form of nephrotomy or nephrectomy. In many cases perinephritic abscesses develop and, indeed, not only in the event of this complication but in the majority of cases of pyonephrosis, the surgeon will conserve life materially and improve his mortality rate by first doing only a nephrotomy for drainage, followed a few weeks later by secondary nephrectomy. In not a few cases transfusion prior to or subsequent to nephrotomy or nephrectomy will be indicated.

Pyonephrosis. Should the ureter become blocked in pyelitis, pyonephrosis develops, or should a hydronephrosis become infected, the pelvis of the kidney becomes rapidly distended and ulceration and dilatation of the calices occur. If the obstruction is permanent, the kidney becomes riddled with

abscesses, but the obstruction is usually incomplete. Closed pyonephrosis occurs when the ureter becomes blocked completely and no pus drains into the bladder, and is found in a few cases of renal tuberculosis. Most cases are related to movable kidney, stone, pregnancy, or old standing disease in the lower urinary organs, as hypertrophied prostate or stricture.

When the pyonephrosis is due to a long existing disease in the lower urinary tract, both kidneys are usually affected, although in different degrees. When the condition is bilateral, the second kidney usually suffers from chronic pyelonephritis and there is seldom any marked development of compensatory hypertrophy.

It is rare that a case of pyonephrosis will diminish in size. Inflammatory tissue gives way to fibrous and fatty tissue and the kidney shrinks in size. The ureter may become obliterated and atrophied. Perinephritic abscess occurs and may burrow in any direction. The patient succumbs to exhaustion from long continued suppuration should the condition not be relieved.

As pyonephrosis is produced by infection and obstruction, relief can only be secured by removing the obstruction and thereby stopping septic absorption. Ureteral catheterization will relieve tension and permit pelvic irrigation, but may not be enough to remove the obstruction in most cases.

Nephrotomy is resorted to for drainage or possibly the removal of a calculus. Many cases being in desperate condition can not stand anything else. The mortality is from seventeen to twenty-three per cent.

After the operation, an improvement in the function of the other kidney is usually noticed. In almost twenty-seven per cent. of cases the wound closes, the sac shrinks, and the patient is cured. A fistula remains in about forty-five per cent.

Where the septicemia persists, due in sixteen per cent. of cases to calculi being left in the sac, or where it may be carried out as a primary procedure, nephrectomy is performed. The mortality of primary nephrectomy is about ten per cent. and that of secondary nephrectomy is about six per cent.

Pyelonephritis. This term is applied to the ascending form of renal infection, while the descending is often described as suppurative nephritis.

The cause is the same as pyelitis and pyonephrosis and it is an unavoidable complication of pyonephrosis. The disease is rapidly fatal, terminating in about ten days or two weeks. All cases do not succumb, the pus probably draining off through the ureter. Such cases are apt to become chronic.

It has been pointed out that cases of chronic pyelonephritis are likely to suffer gastrointestinal irritation, with chronic dyspepsia, a dry brown tongue, secretion of the saliva so scanty that solid food is refused, constipation, often tympany, sometimes uncontrollable diarrhea. The patient is usually extremely weak and depressed and sleeps badly. The symptoms are apt to be progressive and the patient becomes emaciated, extremely susceptible to local congestion from exposure to cold and frequently intercurrent febrile attacks develop. The kidney condition may not bother the patient at all and produce neither pain nor tumor.

Preventive treatment plays a leading rôle. In view of the usual fatal outcome, too much emphasis cannot be placed upon strict asepsis in urinary tract examinations.

Palliative measures are employed as long as there is no pus found or as long as the condition is not progressive, otherwise nephrotomy or nephrectomy is indicated.

HYDRONEPHROSIS.

This condition is produced by chronic retention of septic urine in the renal pelvis and kidney due to obstruction. It is more frequent on the right side and in the female sex. When the obstruction is in the lower urinary tract it is frequently bilateral and also occasionally when the obstruction is in the ureter. Of 665 cases, 217 were unilateral and 448 bilateral.

The obstruction in the ureter is frequently caused by changes in the walls, such as stricture, calculi, tumors, kinking of the ureter due to movable kidney, torsion of ureter and pressure from outside or by tumors, etc.

Congenital hydronephrosis occurs at birth or soon afterward, while the acquired variety may develop at any time. In the male, stricture of the urethra and enlarged prostate produce obstruction and cause bilateral hydronephrosis. In the female, diseases of the pelvic organs and ptosis of the kidneys are the principal causes. When the lower urinary tract is dis-

eased, infection is frequently superadded and pyonephrosis may develop.

The effect on the kidney depends upon the completeness and duration of the obstruction. It is exceptional when the pelvis only is involved, usually the entire kidney is sooner or later implicated, forming a tumor varying greatly in size.

CALCULUS.

Urinary calculus is found at any time in life from infancy to old age, with the majority of cases developing trouble in middle life or later. It would seem that as an individual grows older, urethral obstructions or inflammation, or changes occur in the metabolism which produce alteration in the urine and this predisposes to calculus formation.

Calculi may be formed from normal constituents of the urine, *e.g.*, uric or phosphatic acid; from salts present in excess in disease, as oxalates and carbonates; and occasionally from foreign elements in the urine as cystin.

Uric acid calculi are found mostly in old age, while those formed from sodium, potassium and ammonium urates, occur mostly in children.

In addition to the unexplained tendency to the over production of urinary salts, which form the basis of calculi, there must also be present local irritation which causes these salts to conglomerate. Certain localities are noted for the production of calculi, which may be in any climate and with marked variation in the composition of the drinking water.

Males are affected more often than females and women pass calculi easier than men, which is explained by the shorter and wider urethra.

Calculi may be found in the kidney, bladder, prostate or urethra.

RENAL CALCULUS.

The majority of renal calculi are composed of uric acid or the urates and the oxalate of lime; phosphatic calculi come third in order of frequency. The uric acid stones are found in acid urine, while the reaction is alkaline in the others. The number of stones varies considerably from one up to a thousand, and are usually formed in the pelvis of the kidney or its

branches. Renal lithiasis may be bilateral in about fifteen per cent. of cases.

A stone may form in the kidney and not give rise to symptoms, or a smaller one may develop in the ureteral orifice and block it completely, causing atrophy of the kidney. With partial obstruction to urine through the ureteral orifice, a gradual dilatation of the kidney pelvis takes place, resulting in a hydronephrosis. If infection takes place, a frequent occurrence, pyelonephrosis or pyonephrosis results.

Renal calculi usually develop after the fortieth year and men are affected more than women in the ratio of three to one. The diet, general hygienic surrounding and climate play an important rôle, so that men who lead sedentary lives, live high and in a moist climate are predisposed.

The symptoms resulting from stone in the kidney are produced not so much by the stone itself, as by the obstruction it causes. Large calculi have existed through life undiscovered, while very small ones so placed as to cause obstruction will produce very serious trouble. Pain is a most constant symptom and begins in the lumbar region of the affected side, radiating down the course of the ureter, inside of thigh or bladder into the testicle. The pain may come in paroxysms and be excruciating, necessitating an opiate. Chills, fever and sweat may be associated with the attacks of colic.

Tenderness over the kidney may not be obtained by palpation, but pain produced by deep percussion over the costo-vertebral angle is frequently elicited.

Hematuria is present in most cases either macroscopically or microscopically and clears up between attacks except for a few red blood cells. Pus occurs only when infection has taken place.

The urine may diminish in amount during an attack of colic up to anuria, and should this condition develop, constitutional symptoms of fever, stupor, tympany, dry tongue, hic-cough and uremia occur. This is more prevalent in the bilateral cases.

Frequent urination is noticed, which is better at night, and worse on exertion.

Gastrointestinal disturbances are produced by reflex irritation, causing chronic indigestion.

Occasionally symptoms may point to one kidney and the calculus be located in the other, being caused by the so-called renal reflex.

The diagnosis is made from the symptoms and the findings by cystoscopy and x-ray. The cystoscope will reveal pus or blood coming from the affected ureter and the functional kidney test such as indigocarmin may be delayed on that side. Often in the uncomplicated cases the function may be well within the normal limit and again it may reflexly inhibit the unaffected side as well as the affected. Obstruction to the ureteral catheter is encountered in the majority of stones, although in not a few cases where the stone is sacculated, the catheter may readily pass beyond it. Wax tipped catheters and the presence of scratches may serve to establish the diagnosis in selected cases. The x-ray is the most valuable aid in determining the presence of stone. The patient has to be properly prepared and the bowels well cleaned out the morning of the examination and food withheld until the picture is taken. Calculi formed mostly of uric acid do not cast a very intense shadow. It is important that the examination be conducted by a skilled roentgenologist, otherwise stones may escape diagnosis.

The diagnosis is not always easy. It has been noted that in one hundred and fifty-three patients operated on in a large hospital, twenty-six had had previous abdominal operations without relief of symptoms. In these cases the prominent symptoms were pain in lower right abdominal quadrant (12 cases) abdominal pain without colic (13 cases), backache (11 cases). X-ray was negative in six per cent. The x-ray examination is frequently negative in the very small calculi and we have seen several cases in which no stone could be demonstrated in the plates but the patient passed a very small, sharp pointed calculus in a few days.

With the diagnosis of a renal calculus made the next question is what shall be the treatment? When it is obvious from its size that a calculus located in the pelvis of the kidney or its calices will not pass down the ureter, removal by surgery is indicated. Palliative treatment is reserved for those stones which give promise of passing down the ureter and having passed the ureter there is little further trouble. Severity of

the attack is by no means in proportion to the size of the stone, neither does the severity of the attack indicate the passage of the calculus, because the symptoms are produced by the obstruction.

After allowing a sufficient length of time without the stone having been passed, surgery is advised, because the stone acts as any foreign body and if the kidney is not infected at first, it is only a question of time until it will be, and then the trouble becomes much more serious or grave.

When there is no obstruction nor infection, the prognosis in renal calculus is guardedly favorable. Although a calculus may remain in the kidney for a number of years producing no more symptoms than an occasional attack of hematuria, there is a slow change in the secretive properties of the kidney going on, producing a chronic interstitial nephritis. The longer this has been going on, the poorer is the chance of the kidney recovering its normal function. When the obstruction which is produced is only transitory, no permanent damage is done and recovery is assured, but should the obstruction become chronic with exacerbations, the kidney structure suffers irreparable damage from which recovery of kidney function is rare. When infection takes place on top of this, the prognosis is grave and prompt operation is the only means of recovery.

Therefore it becomes quite a problem to decide what is the best course for any individual. As this process is prone to start in middle life, it resolves itself into how may we prolong the life of an individual suffering from calculus. It is sound advice to recommend operation in all cases where the calculus is not passed in a reasonable length of time, pointing out the fact that early operation is the least dangerous and by waiting until it is a case of necessity death is more likely. Calculus anuria, for example, has a higher mortality. Watson collected 205 cases of calculus anuria:

Treated without operation	110;	deaths	80;	mortality	72.7%
" with "	95;	"	44;	"	46.3%

Our experience has not shown any such high mortality rate. The question of sane surgical judgment is at all times important but extremely so in the infected cases with marked kidney damage. In calculus-pyonephrosis, many patients

have been saved by the so-called two-stage operation—the first being simply a nephrotomy for drainage followed later by nephrectomy, when the patient is able to stand it. Watson collected the following statistics:

Primary nephrectomy	136 cases,	41 deaths	(30.1%)
Secondary	"	33 "	6 " (18.1%)

There are cases in which the kidney is so bound down by dense adhesions, that it is impossible to do anything more than a nephrotomy and removal of the calculi, with palliative treatment for the infection. The prognosis in these cases is poor because there is a marked tendency for recurrence of calculi and the kidney is a constant source of infection. We have several such patients under observation at present; and while one case in particular, that of a woman of forty-nine years who has had two operations for the removal of calculi, is able to enjoy life despite a draining sinus from the kidney, another in a man of forty-five years, who has had two operations and removal of calculi and now has the third formed in the kidney, is in constant misery. Such cases are deplorable and merely furnish human derelicts that reflect the greatest discredit on medical practitioners, who procrastinate early in the course of the disease when surgery is indicated.

There is a marked tendency for calculi to recur and it is important, therefore, to remove the underlying predisposition when possible. Patients may be advised to drink only distilled water—even though this must play but a small rôle in cases of uric acid and phosphatic calculi. Attention is given to the diet and all irritating substances must be avoided. The general hygiene must be regulated. The reaction of the urine is ascertained and kept in a proper state by internal administration of appropriate drugs when necessary.

URETERAL CALCULUS.

Calculi are not formed in the ureter, but descend from the kidney and either remain lodged in the ureter or pass into bladder. If there is no obstruction to the passage, no symptoms are produced—otherwise typical renal colic develops.

About twenty-five per cent. become obstructed at the ureteral orifice of the pelvis, about thirteen per cent. at the middle

constriction of the ureter and more than fifty per cent. of all calculi become lodged just above the bladder in either the intravesical, intramural portion or above. While one calculus is the rule, they may be multiple in about twelve per cent. of cases.

There may or may not be any prodromal symptoms. The patient is seized with acute agonizing pain in the lumbar region radiating along the course of the ureter down into the testicle on the affected side. The pain may be continuous or in paroxysms and may last from a few minutes to days. Cold sweats and reflex vomiting may accompany the attack. Often there is an intensive desire to urinate without being successful. Reflex disturbance of the other kidney may produce anuria. Again, crossed renal pain may be seen as in the kidney. The subsidence of pain may be as sudden as the onset and indicate either the passage of the stone along the ureter or in retrogression with relief from the obstruction. There is nothing to indicate that violent colic helps the passage of a ureteral calculus. The symptoms may subside gradually and recurring at intervals, producing a gradual hydronephrosis. This indicates that the calculus is lodged in the ureter, but does not cause complete obstruction at all times, producing the so-called ball-valve effect, with dilation of the ureter above the obstruction.

The urinary examination during the colic may not reveal anything pathological, which would indicate the presence of one healthy kidney, but following the attack there is a shower of red blood cells.

The diagnosis is made from the history and the cystoscopic findings, such as absence of urine from the ureteral orifice of the affected side with loss of kidney function, or if some urine is getting by the obstruction, a delay in function, or the inability to pass a ureteral catheter into the kidney pelvis. X-ray examination will show the presence and position of obstruction and is the most important diagnostic aid, although not infallible in the case of small calculi of certain composition. Should there be any doubt as to whether a shadow is in the ureter or not, pyelography or a picture with the x-ray catheter *in situ* is resorted to with stereoscopic plates. The presence

or absence of scratch marks on the wax tipped catheter is often misleading.

The treatment depends upon the size of the stone as determined by x-ray and should there be any doubt as to the possibility of its passing, the patient is always given the benefit of the doubt, that it will pass. Palliative measures are employed during an acute attack and an opiate is often required. If there is a possibility that the stone may be passed, the patient is kept in bed and cystoscoped and an attempt made to pass a ureteral bougie or catheter by the obstruction.

The patient is kept in bed for four days and a urinary antiseptic and, according to some authorities, spirits of turpentine are administered by mouth. The patient is permitted to get up on the fourth or fifth day, and frequently passes the stone. The urine is carefully strained through gauze after the instrumentation. If the first dilatation is not successful, a second is attempted when the symptoms of the first have thoroughly subsided. In a large percentage of cases this method will permit the passage of the calculus and operation should be recommended for the unsuccessful.

The same dangers are present in the cases of obstructed ureteral calculi as in renal calculi, namely back pressure on the kidneys and infection, and our aim should be to get rid of the stone before these serious complications occur.

Operation consists of a uretero-lithotomy through either a lumbar or inguinal incision, depending upon the position of the calculus. The calculus can often be pushed up or down to a more favorable site for removal, but in some cases when the obstruction has been long standing scar tissue formation often binds the calculus so tight that it has to be literally pried out of the ureter.

Extraperitoneal ureterolithotomy has an operative mortality of less than two per cent. Transperitoneal ureterolithotomy has a mortality of five and five-tenths per cent.

A calculus lodged in the ureter causing complete obstruction causes rapid and complete destruction of the kidney. If the other kidney is healthy it is able to carry on the function for the body, otherwise the prognosis is grave. The partial obstructions cause the same process, only more slowly, and with

the same end. The prognosis, therefore, is dependent upon the degree and duration of the obstruction.

The majority of calculi that pass into the ureter are discharged into the bladder. Those that do not are observed carefully and should no progress be noted after a couple of dilatations, operation is advised before kidney damage develops.

VESICAL CALCULUS.

The same underlying conditions prevail here for the formation of vesical calculi, with the addition that the presence of foreign bodies form an excellent nucleus, and the retention of urine with decomposition, strongly predisposes to the formation of a subsequent cystitis.

Vesical calculi are found at any age but there is a greater tendency to formation in the older individual, with the majority of cases falling in the fifth and sixth decades of life. The longer urethra of smaller caliber in men explains their greater frequency. The vesical calculus seen in women often surrounds a foreign body.

Preceding the symptoms of stone itself, there may be a history of gravel in the urine with heavy deposits. Renal calculi descending through the ureter may act as a nucleus for bladder deposits, but they usually pass into the urethra without much delay.

A calculus in the bladder acts as a foreign body and produces pain, which is most marked at the end of urination and is referred along the urethra to the end of the penis. This is produced by the stone coming in contact with the vesical neck. The intensity of the pain largely depends upon the intensity of the cystitis present and the size of the stone. Large stones are apt to give less symptoms than small ones that drop down into the vesical neck. The smooth variety gives less trouble than the rough. Occasionally large vesical calculi are found that produce few or no symptoms.

Frequency of urination is most marked by day when the patient is up and around on his feet, and less marked when the patient is at rest, as at night. There is urgency and often a complete cessation of the stream, due to the calculus dropping down into the vesical neck. Tenesmus often accompanies the frequency.

Hematuria is a common symptom and is produced by ulceration due to the calculus. It is apt to be slight.

Infection is nearly always present producing a cystitis, usually of a chronic type with pyuria, from which absorption is likely to take place giving symptoms of toxemia.

The diagnosis is easily made with a stone searcher, cystoscope and x-ray. The cystoscope may indicate the chemical formation of the stone and the best course for treatment, also differentiate other conditions and complications frequently present, thus leaving little utility for the time honored stone-searcher.

If the stone is small it may be removed by cystoscopic rongeur, or if not too large nor too hard, and freely movable may be extracted by litholapaxy. Others have to be removed by suprapubic or perineal cystotomy, the majority being removed in this way.

The dangers attending a crushing are greater than a cystotomy and it is therefore not advised in cases where it is necessary to remove the calculus with as little shock as possible, without the danger of an ascending infection due to cystitis.

As most cases have an accompanying cystitis litholapaxy may not be well tolerated, hence cystotomy serving both to remove the calculus as well as to drain the bladder is safer and usually preferable.

The mortality of lithotomy is about three per cent., while litholapaxy in the hands of skilled surgeons averages around two and five-tenths per cent.

A calculus acting as any foreign body produces irritation to the bladder walls, which causes them to hypertrophy and sets up a cystitis, which is chronic and therefore exists for a long time even after the calculus has been removed, acting as a source of general infection and absorption of toxins. The prostate becomes chronically congested and inflamed, and is often hypertrophied, favoring retention of urine. The infection then may ascend the ureters and reach the kidneys producing pyelonephritis. Exceptionally a stone may ulcerate through the bladder wall. The prognosis of vesical calculus is always guarded, not so much from the calculus itself, as from the many complications that usually accompany it. The shorter the duration of the stone the less damage as a rule,

although stones may gain considerable size in a short time. A patient operated on not so long ago had a calculus the size of a hen's egg formed around a piece of rubber dam as a nucleus, which had dropped down into the bladder following a suprapubic cystotomy about ten months previously.

The cystitis accompanying the calculus is the main objective. If this cannot be cleared up and the predisposing factors be removed there is apt to be recurrence and possibly an ascending infection.

URETHRAL AND PROSTATIC CALCULI.

It is the exception that calculi are formed in the urethra and are usually found in infancy and old age. The common seats are the prostatic urethra, bulbomembranous urethra and fossa navicularis. They are easily discovered and removed before any permanent damage has been done, excepting those in the prostatic urethra, where they may cause marked dilatation, congestion and inflammation. The stones found in the prostatic urethra may be formed in the bladder or prostate and then lodge in the urethra.

When corpora amylacea enlarge, they excite inflammation acting as foreign bodies, and with the deposition of lime salts produce calculi. The stones may be separate or may fuse together. They are usually black or brown in color and sometimes are not any larger than bird seed.

Chronic prostatitis predisposes to the formation of calculi and in those cases that do not seem to do well with massage, etc., but complain of vague pain and tenderness in this region, the possibility of calculi should be borne in mind and the patient should be x-rayed. Prostatic calculi may be found at any age, especially in those with a previous history of prostatic inflammation. They are more common in middle and old age. Palpation often reveals their presence, while in some cases they are not suspected until the x-ray examination reveals their shadow. In a majority of cases the condition is not suspected or recognized until after the patient has suffered a long time and been subjected to considerable unnecessary treatment.

In old men a prostatectomy is usually performed, but this is not always advisable in men in middle life as a prostatectomy

usually renders an individual sterile and impotent. With a prostatotomy and removal of the stones, it is not always possible to remove all of them by simple incision and the patient may not be relieved. The presence of prostatic calculi in a young man or one of middle age, predisposes to sterility.

TUMORS.

The neoplasms of the urinary tract play an important rôle in middle life for the reason that the malignant tumors are highly malignant and must be recognized very early to be of any benefit to the patient, and that the benign tumors show a marked tendency to undergo malignant degeneration if left untreated.

Classification of tumors of the urinary tract, especially those of the kidney and testicle, offer considerable variation in terms, which makes comparative study rather difficult.

KIDNEY.

Primary tumors of the kidney are not common, less than one per cent. of malignant tumors taking origin there, while the percentage of benign is even smaller. Secondary tumors of the kidney do not come into this discussion.

Benign tumors of the kidney are usually not discovered unless located in the pelvis when they give rise to hematuria. They rarely attain large size and seldom give rise to symptoms. They play no rôle in middle life with the exception of papilloma situated in the kidney pelvis. This is the commonest tumor of the pelvis and is most common in middle age. It may be single or multiple and produces no symptoms until painless bleeding occurs. The diagnosis is difficult to make except by surgical exploration. Pyelography often aids and when blood is seen coming from a ureteral orifice, exploration is indicated unless it can be proved to be of inflammatory origin. There is a marked tendency to undergo malignant degeneration. The prognosis is good if diagnosis is made before malignant degeneration has occurred, otherwise it is grave.

Malignant tumors of the kidney are unilateral when primary and are found in childhood and after the thirty-fifth year but

seldom in the interval between. The right kidney is affected more than the left and males predominate.

A series of 160 cases prepared by Kelynock showed:

Age		Cases
Up to 1	year	12
1	" 2 years	23
2	" 3 "	16
3	" 4 "	17
4	" 5 "	6
5	" 9 "	10
9	" 10 "	0
10	" 25 "	7
25	" 35 "	8
35	" 45 "	17
45	" 55 "	22
55	" 75 "	22

The commonest malignant tumor of the kidney is the so-called hypernephroma or more properly termed nephrogenic mesothelioma. The etiology is not definitely known. They vary considerably in size from microscopic up to so large they change conformation of abdomen. They originate in the cortex, frequently near the lower pole. Metastasis occurs through the blood stream with the liver the most frequent site.

Mixed tumors and sarcoma are the predominating types seen in childhood and only rarely in middle age.

The various types of carcinoma are the commonest next to hypernephroma and are rare before the fifth decade.

Tumors of the kidney produce pain, hematuria and swelling—in order of their frequency. The important point in hematuria, is to cystoscope the patient during an attack and determine from whence the blood originates. Due account must be given to accompanying pathology such as stricture, prostatitis with congestion of posterior urethra, enlarged prostate, etc., but it must be borne in mind that while these may account for some of the symptoms, there may be other lesions higher up in the urinary tract. Cystoscopy with functional kidney tests and pyelography are indispensable in order to arrive at a diagnosis, and an exploratory operation is much preferable to procrastination, during which time the tumor may progress to an inoperable or incurable state.

As a general rule, a patient who has had symptoms of a renal tumor for more than two years is regarded as inoperable, but

unless there is external evidence of metastasis, exploratory operation with possibly a nephrectomy is advised. X-ray therapy is used before and after operation.

Without operation the ultimate outcome of malignant disease of the kidney is inevitably fatal, the average length of life from the onset of symptoms being about three or four years, death resulting from hemorrhage, renal insufficiency, asthenia or from metastasis to vital organs. Operative mortality is about ten per cent. The prospect of permanent cure depends upon the duration of the disease at time of operation.

The prognosis resolves itself into how quickly the diagnosis can be made and operation performed. The patient with a hypernephroma is usually in the prime of middle life and unless the first danger signals are heeded and properly investigated, the golden opportunity is lost. Too often the painless, intermittent hematuria is regarded lightly by the attending physician, as it often disappears for months upon the administration of a urinary antiseptic and rest—only to reappear again. Most patients, if the condition is pointed out to them in the proper light, will submit to an examination and possible operation at the first appearance of the trouble, and it is up to the physician to insist upon a thorough examination when any suspicious symptoms appear. If the laity can be educated to report to urologists for examination for urological conditions when anything of a suspicious nature appears, then and not till then can we hope to make an advancement in the cure of this ominous disease and a reduction of the mortality.

BLADDER.

Tumors of the bladder, which constitute about three per cent. of diseases of urinary organs (Kester), are usually classified as benign and malignant, but the benign have a marked tendency to undergo malignant degeneration, so that a majority of bladder tumors are malignant. Carcinoma is the commonest malignant, while papilloma is the commonest benign tumor. Men are more frequently attacked than women and the workers of dye stuffs seem predisposed to bladder tumors. Tumors may develop at any age, but are most common from forty to sixty years. Vesical growths are mul-

tiple in twenty-five per cent. of cases and have a great tendency to recur. Small, well pedunculated growths are apt to be benign, while large, infiltrating, sessile tumors are commonly malignant.

Papillomata are multiple in about forty per cent. of cases and vary in size from a pea to an orange. They have to be regarded as potentially malignant, for not only are they prone to develop malignant changes, but have a tendency to recurrence, either locally or in other parts of the bladder.

They are frequently the cause of "painless hematuria" and uncomplicated produce but little change in the general health.

The diagnosis is easy by the cystoscope, the only difficulty being in deciding whether the tumor is benign or malignant and it is here that the trained cystoscopist plays his most important rôle. To excise a benign growth is not considered the best form of treatment at present and to treat a malignant tumor as benign is often losing valuable time if complete removal is being considered. A necrotic condition of the villi, nodules in the mucosa, failure of the slough caused by high frequency to separate promptly, together with palpable induration when the posterior wall is affected are significant of malignant change. Roentgenologists claim to be able to differentiate between benign and malignant bladder tumors by injection of air into the bladder with x-ray, but this should not supersede cystoscopy.

Papillomata are treated by the Oudin or D'Arsonval high-frequency currents, which are usually very effective. The patient is kept under observation at regular intervals to insure early treatment should there be any recurrence. Radium has been used to prevent recurrence.

The prognosis is good and general health need not be affected if this régime is carried out and the patient may have every expectation of rounding out his full number of years with no difficulties. Those cases that show a tendency to malignant degeneration have not quite as good a prognosis and should the diagnosis of carcinoma be absolute, the prognosis is guarded. There is a possibility of the patient undergoing treatment having a hemorrhage from the base of the tumor as it ulcerates. Rest in bed usually is sufficient to control this, although the bladder becoming distended with blood clots

and with retention of urine may necessitate a suprapubic cystotomy.

Vesical cancer is usually sessile and involves the whole thickness of the bladder. The growth is extremely slow but metastasis may occur very early. Hardening of the bladder wall, felt by rectal palpation is almost pathognomonic of cancer. Hydronephrosis, pyelitis, pyelonephritis and pyonephrosis following cystitis are common.

If there is any doubt about the diagnosis a portion of the growth may be excised through the cystoscope, or by direct cystotomy, and examined microscopically.

When the patient is seen very early, which happens only infrequently, complete removal is considered if the tumor be so located as to permit this. A partial cystectomy offers the best results. In those cases where the trigone is affected and seen fairly early partial cystectomy with transplantation of the ureters may be advised, or grouped with the cases that heretofore have been regarded as inoperable. A suprapubic cystotomy is performed with as complete a removal of the growth as possible by fulguration and implantation of radium. This offers the best means of combating the malignancy that we have at present and while it is not claimed that such patients are cured, it is believed to prolong life and lessen symptoms.

In those cases in which the disease has invaded the majority of the bladder wall, including the vesical orifice, and the general condition of the patient is not good, suprapubic cystotomy has to be performed, also in those otherwise inoperable cases that develop retention.

The prognosis in carcinoma of the bladder is bad in all cases except the very early ones, where a complete resection is carried out with a fair prognosis. The tendency is to show progression with metastasis and the patient perishes from hemorrhage or ascending infection. Cases of carcinoma of the bladder have lived four or five years after the beginning of symptoms, without any treatment and it is a question in some surgeon's minds whether operative intervention really lengthens life.

Certain cases which appear benign clinically, and are reputed as malignant under the microscope, have a better prog-

nosis with surgery as the fulguration at the base of the growth may be sufficient to destroy the cancer cells before they have penetrated deeply.

Partial Resection.—In ninety-six cases, mortality twenty-one per cent.

Late Results.—In fifty cases of partial resection, there was recurrence in fifty per cent. within three years, and in ten per cent. there was no recurrence.

Cystectomy.—In thirty-nine cases, death occurred after the operation in eighteen per cent., a mortality of forty-six per cent. One was well five years afterwards and one sixteen years.

PROSTATE.

Malignant disease of the prostate may be sarcoma or carcinoma, the latter being much the more common. Sarcoma may occur at any age but is usually found in the first to the third decades and fortunately is very rare. It is rapidly progressive and x-ray therapy is the only hope of combating it. The result is usually fatal.

Carcinoma of the prostate is a disease of men over forty years, rarely found before fifty years and with fifty per cent. occurring in the seventh decade. An average of forty cases was sixty-five years, one beginning at forty-four and another at forty-eight. At times it is hard to differentiate from prostatic hypertrophy, even at operation and about ten per cent. of hypertrophy of the prostate cases will show early carcinomatous degeneration.

The diagnosis must be made early to be of any benefit to the patient and when the diagnosis is unmistakable the outcome is usually fatal.

Implantation of radium under direct vision through suprapubic and perineal incisions and x-ray crossfire has a tendency to prolong life and relieve symptoms. The tumor is prone to metastasis before producing many prostatic symptoms.

Again those cases where the diagnosis of malignancy is made by the laboratory and not by the surgeon, have by far the best chance.

TESTICLE.

All tumors of the testicle are classified as teratomata, by Ewing, who showed in 1911 that while testicular tumors may have a preponderance of a certain type of cell, yet when completely studied will be found to be of a complex nature.

Teratoma testis is essentially a disease of middle life affecting men in their prime, more than fifty per cent. occurring between thirty and forty years. The etiology is unknown although trauma may play a minor part and improperly descended testicles are predisposed to undergo malignant degeneration.

The diagnosis may be difficult in the early stages and for this reason all cases that are regarded with suspicion should have an early operation. In the early stages the epididymis may be uninvolved, but later it becomes infiltrated and confluent with the tumor. Hydrocele or hematocele may complicate the condition from the beginning and conceal the enlargement. Metastasis occurs to the retroperitoneal lymph nodes as in carcinoma.

Teratoma is more highly malignant than any other tumor of the body and the prognosis is bad, especially when metastasis has involved the retroperitoneal lymph nodes. It has been stated that the average duration of life is twenty-three months, patients living about six months after operation, since they do not consent to operation until they have suffered from the disease a year or more. A case is reported living fifteen years.

A few cases of radical cure have been reported. Winiwaiter, among twelve cases found one living two years and seven months after operation. Robin reported four cases living three years, Kocher out of six cases, two well one year after operation; one, one and one-half years; one four and one-half years; one eight and one-half years and one ten and one-half years, and in only one instance was the operation performed early.

Operation consists of orchidectomy with reflection of the peritoneum and removal of the retroperitoneal as well as the inguinal lymph nodes. X-ray crossfire is important.

At best the expectancy of life is very poor with most cases, and the following case histories may be of benefit to show the difficulty of diagnosis and the high mortality.

CASE I. P., Age 39 years.

C. C., Swollen testicle.

H. P. I., Patient suffered an attack of urethritis 6 months before and right testicle became swollen and painful so that he was in bed for a week, but got out before it had completely subsided. This became worse 2 months ago and he went to bed for 3 weeks. His physician tapped the swelling and removed some fluid. The right side of scrotum was larger than a fist and was apparently cystic, but did not transmit light.

He was admitted to the hospital where an orchidectomy was performed followed by x-ray treatment. Laboratory diagnosis was teratoma testis.

Patient died 16 months later of retroperitoneal metastasis.

CASE II., J. age 25 years.

C. C., Swollen testicle.

H. P. I., Six months ago following exposure to cold and wet developed pain on urination lasting a week. No history of venereal infection. This was followed in a week by a swelling of the right testicle, which has not subsided. No dysuria nor frequency. No pain in testicle. Has gained 15 lbs. in weight in the last year.

Per rectum the right seminal vesicle is enlarged and infiltrated. Right testicle is enlarged 4 times normal size. Does not transmit light. There is a small hydrocele of cord above testicle. Urine negative.

Chromoureteroscopy—Bladder O. K. Indigocarmine intravenously appeared from R. U. O. in 9' and L. U. O. in 9'.

Orchidectomy followed by x-ray treatment.

Laboratory report—teratoma testis.

Several weeks later patient complained of headache, expistaxis and became blind suddenly and fell over to floor and died in two hours.

URETHRA.

Papillomata occur in the urethra and while the pathology which they produce is not so damaging, yet the condition persists, if unrecognized, and by its mere presence may undermine the patient's well being. The same may be said for polypi of the urethra which occur as a complication to chronic prostatitis, and reduces a man's efficiency by constant local irritation. If an individual is bothered constantly with frequency, burning, etc., and is not relieved by his physician who has not discovered the local irritation, it does not take such a long time to throw him out of balance physically.

These growths do not as a rule develop into anything else and respond readily to the high frequency current and topical applications of silver nitrate through the endoscope.

PENIS.

Condylomata or venereal warts are common in youth and early middle life and are produced by local irritation. If this irritation be removed the condition will either disappear spontaneously or will clear up rapidly with little treatment. If utterly neglected, they ulcerate and suppurate and act as a focus for inguinal adenitis and suppuration. Exceptionally they form a starting point for carcinoma.

While epithelioma of the penis is usually seen in old age, it may be encountered in middle life. It is chiefly met with between the ages of fifty and seventy, is rare before forty-five years and is most common at fifty-five years. The presence of a redundant or phimotic prepuce, accumulations of smegma, sub-preputial calculi, chronic balanoposthitis act as predisposing causes. Epithelioma progresses very slowly and metastasis occurs to the inguinal lymph nodes.

If seen early, a partial amputation of the penis with removal of the inguinal glands and x-ray therapy give a fairly good prognosis. Later cases necessitate complete extirpation of the penis. While most men would rather part with anything than the penis, it usually occurs at a time of life when procreation is a thing of the past and when presented in the proper light, the patient will invariably consent. Even in the late cases when there is involvement of the inguinal lymph nodes macroscopically and microscopically, patients seem to do well and the mortality is apparently not as high as carcinoma located at other places along the urinary tract.

Of one hundred cases Dellinger and Barney found recurrence in thirty-nine per cent. in first year and sixteen per cent. in the second and third years. Only twelve per cent. showed recurrence after five years. Survivals of five to ten years are not uncommon, and survivals of twelve and twenty-nine years are recorded.

In total emasculation for very extensive growths survivals without recurrence for one year, fifteen and sixteen months, and three years have been recorded.

TUBERCULOSIS.

Tuberculosis of the urinary tract may be one of many lesions of a general iniliary tuberculosis, or it may be a localized process, perhaps the only discoverable lesion. It is regarded as always secondary to tuberculosis elsewhere in the body, whether discoverable or not. Primary tuberculosis is spoken of and by this is meant the primary lesion in the urinary tract.

Urinary tuberculosis is seen in those individuals who have had a small but very active focus at one time or another rather than in the massive pulmonary infections that become walled off.

It is essentially a disease of middle age occurring mostly between the twentieth and forty-fifth year, although by no means confined to these limits. Males are affected more frequently than females, in the proportion of two to one.

Renal tuberculosis is the commonest primary seat in the urinary tract and occurs chiefly as a hematogenous infection, although there are many cases of lymphogenous or ascending infection; occasionally the kidney becomes infected by the urine backing up from an infected tuberculous bladder and also by contiguity from perinephritic infections, Pott's disease and intestinal tuberculosis, and is usually unilateral.

Bilateral tuberculosis in the majority of cases begins on the two sides at different times, with an interval of years between the time of infection of the other organ. When but one kidney is infected, the other is in danger from two sources; first, the tuberculous infection, and second the development of a nephritis as a result of toxins eliminated from the other kidney. It has been observed repeatedly that the function of the good kidney has improved after the infected one has been removed.

There are no symptoms as long as the renal substance alone is affected, but the syndrome of pain, hematuria and pyuria develop when the abscess ruptures into the pelvis.

Frequently the kidney symptoms may be masked by the general infection or its complications and the original source of the trouble overlooked. This is true of a severe tuberculous cystitis, when all the symptoms point directly to the bladder,

and occasionally when an epididymitis is the first warning to the patient.

It is often difficult to make a diagnosis in early renal tuberculosis. It may be found in the corpulent individual as well as the lean and recently a tuberculous kidney was removed cystitis, when all the symptoms point directly to the bladder, from a nurse who weighed well over two hundred pounds. With marked involvement of the bladder, the trained cystoscopist needs but little else to make the diagnosis, the next thought being which kidney is the seat and whether both are involved. The presence of tubercle bacilli in the urine depends upon how assiduously the examination is conducted, and should be found in a large percentage of cases. Indigo-carmin plays its stellar rôle as a functionable kidney test in renal tuberculosis, as it is poor technic to catheterize the unaffected ureter in the presence of vesical tuberculosis.

With the diagnosis of tuberculosis established, and one functionally sufficient kidney, nephrectomy is indicated. In the bilateral cases, except in acute miliary tuberculosis, palliative treatment in conjunction with tuberculin gives the best results. The presence of a pulmonary tuberculosis is not a contraindication in itself to operation, unless manifesting activity. The avoidance of ether as an anesthetic is probably a matter accorded too little consideration in nephrectomy for tuberculosis.

Untreated the ultimate prognosis of renal tuberculosis is bad. A few cases may heal, constituting the so-called closed renal tuberculosis, but these are so rare as to be unworthy of consideration. The progress is usually very slow, but more destruction is going on all the time and toxins are being absorbed which gradually decrease the vitality. It is not proper to delay operation in the hope that the administration of tuberculin will bring about a cure, this is only an adjunct when the source of the infection has been removed and is used in conjunction with the general hygienic measures that constitute a good anti-tuberculous régime. The prognosis in unilateral renal tuberculosis is good in proportion to the promptness with which the diseased kidney is removed. The operative mortality has in recent years decreased from thirty per cent. to less than three per cent. Over eighty per cent. of persons

with this condition are cured or improved by nephrectomy and seven and five-tenths per cent. permanently.

It has been stated that about ten per cent. of patients who die after nephrectomy do so during the first two years and only about three per cent. die of tuberculosis thereafter.

Tuberculosis of the ureter is secondary to tuberculosis of the kidney or bladder. The ureteral orifices become rigid and present the so-called golf ball type. The treatment is directed to the primary focus and as much of the ureter as possible is removed at nephrectomy.

Primary tuberculosis of the bladder is extremely rare, being usually secondary to renal tuberculosis, though it may in a minority of cases become involved from the epididymis, seminal vesicles or prostate gland.

It produces very distressing symptoms of which frequency of urination is most marked. The bladder symptoms may be so severe that they overshadow any symptoms that might be referable to the kidney, and unless this is borne in mind the original focus may be overlooked. The majority of patients with urinary tuberculosis will have bladder involvement when they present themselves for examination, if they have not the post-operative convalescence is much quicker, because a tuberculous cystitis persists a long time, perhaps a year or more after the focus has been removed. Indeed vesical irritation is the chief and only symptom of renal tuberculosis in ninety per cent. of patients. When the primary focus cannot be removed, only palliative measures are employed in treatment. It is characteristic that a tuberculous cystitis will not tolerate silver nitrate. With the focus removed general hygienic measures are indicated and the cystitis may be benefited by injections of 6 per cent. phenol or gomenal oil 10 to 20 per cent. The reaction following such an injection should have thoroughly subsided before the next is attempted.

These patients have considerable distress no matter what is done for them and the danger remains that as long as the tuberculous cystitis is present, the other kidney may become involved due to an ascending infection.

With the original focus removed, the prognosis is good.

Tuberculosis of the prostate occurs in the prime of life along with vesiculitis, epididymitis and cystitis. While occasionally

a spontaneous cure may take place through sclerosis, the prognosis is regarded as poor.

The presence of bloody ejaculations leads one to suspect there may be tuberculosis of the seminal vesicle, and is seen in association with other tuberculous lesions as prostatitis and epididymitis. As a rule when a tuberculous epididymitis becomes demonstrable, the vesicle in the affected side is palpably involved.

Palliative treatment is usually employed in conjunction with tuberculin and surgery should be avoided if possible. Some cases have been reported cured after a vesiculectomy while others clear up after the original focus, as an epididymis, has been removed, otherwise the prognosis is poor.

Involvement of the testicle and epididymis may occur at the same time, or more often primarily in the epididymis. In a small percentage of cases this may be the primary seat in the urinary tract or it is dependent upon a renal tuberculosis with a cystitis. Many cases come under observation that have had some operation on the testicle, without removing or recognizing the primary focus in the kidney.

There may or may not be any symptoms, with the patient often discovering a lump in the epididymis as the first indication. It makes but little difference whether it be located in the globus major or globus minor. There is marked tendency for its development in patients with a tuberculous family history. Often there is difficulty in making a diagnosis and the tuberculin test, applied diagnostically with O. T., is a reliable guide.

Before attempting any treatment, it is essential to ascertain that there is no focus higher up in the urinary tract, as a kidney. Bilateral cases call for palliative measures. The formation of free pus demands surgery and excision of the involved epididymis, or even orchidectomy when the testicle is involved is urged by some. The conservative operation and treatment is indicated, due to the great tendency to become bilateral. The young seem to have a better chance with tuberculin combined with a careful anti-tuberculous régime.

The tuberculous nodules may break down, form a fistula or become encapsulated and absorbed, leaving a mass of fibrous tissue to mark their position. This does not necessarily mean

that a permanent cure has been established, as under favoring circumstances a tuberculous focus may again become active and with greatly increased virulence. Yet spontaneous cure may result from such a process. The prognosis is unfavorable in the cases of rapid development, being better in the slow and indolent variety. The greater the involvement, the less chance of cure. The tendency to become bilateral is unfavorable as is the association with a diffuse urinary tuberculosis. When the process is located solely in the epididymis or testicle and is removed promptly by surgery, the outlook is fair, with associated involvement of other structures, the palliative method is indicated and the prognosis is guarded.

In the slow and indolent variety, the patient is able to be around and attend to his affairs, reporting regularly for tuberculin therapy and usually do well. As it is possible for infection to take place during coitus, sexual relations should be avoided.

MALFORMATIONS, ETC.

The urinary tract is subject to congenital malformation and anomalies, which while not producing any immediate effect upon life in themselves often potentially are factors in producing disease. Abnormalities of the kidney are found once in every two hundred and eleven cases and comprise single, supernumerary, horse-shoe and pelvic varieties. Males are affected more frequently than females. The left kidney is affected more than the right. Infection occurring in such individuals is obviously not borne as well as in normal cases and the important fact of determining that a man has one functioning kidney before removing the other is too well known to emphasize.

Movable kidney is seven times as frequent in women as men. At most from five to ten per cent. of women and one-half to one per cent. of men have abnormally movable kidneys. In twenty per cent. of cases both kidneys are abnormally movable. The left kidney alone is rarely affected. The greater frequency (80 per cent.) with which the right kidney is involved is explained by its relation to the liver and greater length of its artery. It is prevalent between twenty and fifty years.

A wide range of motion may cause neither symptoms nor pathological change, whereas a small displacement may occasion considerable trouble and be difficult of diagnosis. This may be explained by a kinking or obliteration of the lumen of the ureter. Nephroptosis is often associated with a general ptosis and relief cannot be obtained without treatment to the latter condition. Neurasthenia is also commonly associated.

The prognosis is bad where the condition has produced some pathology of the kidney with changes in the urine. When the pain is slight and occurs only at long intervals and the kidneys can be kept in position by a belt or appliance, the outlook is favorable. Sooner or later a movable kidney, which begins to degenerate, profoundly alters general nutrition often producing a condition of melancholia or neurasthenia. The gastrointestinal symptoms progress until the mechanical cause is removed.

Nephropexy is advised where there is pain in the kidney region, Dietl's crises or urinary disturbance, and in fifty per cent. of cases is attended with good results. The operative mortality is less than one per cent. When it has been unsuccessful and the symptoms are severe and progressive, nephrectomy is justified.

Exstrophy of the bladder is commoner in males and usually consists in the absence of the anterior wall. It is often associated with bilateral inguinal hernia, rudimentary prostate and ectopic testicles. The seminal vesicles are either absent or atrophied. The great danger in such a condition is an ascending infection to the kidneys, and patients exhibiting this deformity are of poor physical development in other respects and often perish before attaining middle life. In the male there is sterility and in the female, while pregnancy may occur, it is beset with many difficulties. Such abnormalities are difficult to cure and the prognosis is always guarded.

Diverticula of the bladder presents a poor prognosis unless they are small enough for radical excision. Infection, which is difficult to eradicate plays the chief rôle and septic absorption renders the patient a chronic invalid.

Improper descension and ectopy of the testicle predisposes to malignant degeneration. Hernia and inflammation are also associated. Abdominal cryptorchidism is difficult to remedy

and it is a question whether anything should be attempted except possibly repair of a hernia if it is present. The testicle is better off in the abdominal cavity, even though it may undergo degeneration, than it is in the inguinal canal or possibly removed. In inguinal cryptorchidism, the gland is either brought down into scrotum and anchored there or else removed. This is best done before puberty. The testicle which has remained undescended usually atrophies, but may increase greatly in size to normal after operation.

Hypospadias and epispadias produce no symptoms nor cause any discomfort if they are confined to the glans, but more proximal than this may be of serious inconvenience to the patient, although not affecting the general health. Procreation is usually impossible and even urination may greatly inconvenience the patient. The operative cure of these cases is difficult and can only be obtained after a series of operations extended at times over many months.

HYDROCELE.

Hydrocele is most common in infancy and old age. Acute hydrocele, due to inflammation, is associated with disease of the epididymis, as epididymitis, and is mainly seen in young adults. The symptoms are produced mainly by the disease which causes the hydrocele and the patient has to keep to his bed. Acute hydrocele usually undergoes resolution, or it may become chronic, constituting the usual form of hydrocele. Suppuration occasionally takes place.

Chronic hydrocele is the ordinary type and is mostly a disease of old age, the average being sixty-seven years. The right and left sides are affected about equally, and in about thirty-three per cent. of cases is bilateral. While mostly associated with inflammatory disease of the epididymis and testicle the etiology is not definitely known. The important feature of the diagnosis is the translucency to light, which may be lacking due to a chronically thickened wall. We have observed such a case in which no light was transmitted, the walls of the sac being about one-half inch thick.

Spontaneous cure may take place in infants, but is very rare in adults. Hydrocele in itself is not dangerous to life, but it

encourages the development of hernia and may lead to testicular atrophy and occasionally suppurates. It may rupture into the tissues of the scrotum as a result of traumatism. By its presence and size it may render a man unfit for work besides producing a tumor in a region that is rather difficult of concealment.

Simple tapping may produce a cure especially in infants and the inflammatory variety. In the chronic hydrocele there is mostly a reaccumulation of fluid, which may be removed from time to time as indicated by distention.

The radical operation is usually advised and permanent cure is usually attained.

VARICOCELE.

Varicocele is most common in young adults, being most frequent from the fifteenth to twenty-fifth year, it is rare in infancy and in old age is usually a moderate development and causes little inconvenience. A moderate degree of varicocele is said to exist in about ten per cent. of male subjects, a marked degree is much less frequent. In about ninety-seven per cent. of cases the left side is affected, while the right is only affected in about three per cent. of cases. Bilateral cases exist in about two per cent.

In most cases varicocele tends to improve and eventually disappears spontaneously and it is very rare in old age. Observed in young men subject to prolonged and ungratified sexual excitement it is usually cured by marriage, or, at least, it ceases to give trouble thereafter. If moderate in degree it has no marked tendency to increase, causes little pain and does not appreciably alter the nutrition of the testicle. Only when varicocele is so pronounced that circulation is materially interfered with does atrophy of the testicle result. In poorly nourished individuals and those given to mental anxiety, aching pains are frequent and the condition assumes an exaggerated importance and hypochondriasis may develop.

Where palliative measures of cold douches, suspensory, etc., do not relieve the patient, radical operation is indicated and in a majority of cases no further trouble is experienced after the operation.

SYPHILIS.

There is no disease which has a greater tendency to hasten middle life, bring on premature old age and early death than syphilis. The importance of syphilis to life insurance risks has demanded in recent years additional consideration. This has arisen by virtue of the discovery of the *Treponema pallidum* and the advent of the Wassermann reaction, whereby further evidence substantiates the recognition of syphilis as the cause of paresis, tabes, and aneurism, and one of the chief factors in other types of arterial and cardiac disease, particularly in patients under fifty years of age. The studies of parasymphilis and the so-called luetic sequelæ have clearly shown that these are misnomers, and that in truth we have to deal with a definite syphilitic process in the lesions of which living treponemata can be demonstrated.

The incidence of syphilis has been estimated by various observers, but can not be determined accurately. The result obtained from the Wassermann reactions of a certain group of cases is not reliable for the population as a whole. Various figures from Germany would indicate that about twenty per cent. of the adult population are infected. Fournier estimated that fifteen per cent. of the adult population of Paris have syphilis. In the United States, the findings have been from twelve to twenty per cent. among the insane, and in a general hospital from ten to twenty per cent. of all patients exhibit signs of the disease. It has been estimated that the percentage for the negro race is about twice that of the white race, but the female is infected in the same proportion as the male, while in the white race men are infected about three times as frequently as women. Conservative estimates would place the number of syphilitic individuals in the United States as five to eight millions.

The autopsy findings are at variance with these figures. Symmers found from a study of gross anatomy in 4880 autopsies performed at Bellevue Hospital, six and five-tenths per cent. showed evidence of syphilis. Warthin, pointing out that the gross anatomic study as done at the autopsy table is not enough to establish a diagnosis of syphilis in the majority of cases, found evidence of syphilis in three hundred cases in

seven hundred and fifty autopsies. According to Graves, post-mortem Wassermann reactions confirm the ante-mortem report in nine per cent. of cases.

Our conception of syphilis in relation to middle age is two-fold: The morbidity and mortality of syphilis incident to deep seated visceral disease speedily threatening the life of the individual, and the influence on vital resistance predisposing the victim to the acquisition of all other diseases, notably tuberculosis. The mortality charts of the large life insurance companies give reliable data. Most of the large companies will not issue a policy to an individual, who admits he has had syphilis. In thousands of deaths among insured lives, the minimum death rate due to syphilis is five and two-tenths per cent.; the maximum being fifteen per cent. (Tiselius, Solomonsen, Blaschko, Kleinschmidt, Runeberg, Weber, Bramwell, Andry). Thus syphilis ranks higher than pneumonia as a cause of death and stands second only to tuberculosis. Kleinschmidt finds the average age at death of syphilitic policy holders to be forty-five years, the average duration of insurance to be ten to fifteen years, and the average length of time between infection and death to be twenty-one and five-tenths years. This with non-syphilitic policy holders shows a decrease in longevity of three and five-tenths years, and in duration of insurance of approximately one and five-tenths years. Gollmer estimates that the average extra mortality among syphilitics is sixty-eight per cent. over other insured men at all ages. This series was made up almost exclusively of diseases of the central nervous system, the heart, the vessels, and the kidneys. Five thousand, three hundred and eighty-five policy holders in American insurance companies, admitting syphilitics, showed a death rate of thirty-three and three-tenths per cent. above the expectation. It will be borne in mind that the mortality is, furthermore, powerfully influenced by age, climate, race, alcohol and most of all by treatment.

In addition to the number of deaths that directly result from this infection, syphilitic women do not bear the number of living children they otherwise would. Many miscarriages are directly traceable to syphilis, as are many deaths among the newborn.

It has been estimated that the total economic loss is nearly half a billion dollars a year to the United States alone (Hazen). In addition to this financial loss there is an immense amount of suffering, both among the innocent and guilty, many separations in families and losses in many other ways.

Pathology. Syphilis is caused by a specific motile organism, the *Treponema pallidum*, discovered by Schaudinn in 1905 and quickly confirmed by Hoffman and Metchnikoff. In the acquired form the initial lesion is upon the genitals in ninety-four per cent. of cases, the infection being the result of sexual intercourse. The remaining six per cent., are classified as extragenital and occur most frequently on the lips, tongue, breast, tonsils, hands, etc., and while the infection may be contracted innocently—so-called, yet it may result from perverted sexual habits.

The incubation period is generally regarded as twenty-one days—although some observers claim that it is nearer four weeks.

The primary lesion is called a chancre and may be multiple in from ten to fifteen per cent., but is usually described as a single sore. The commonest site in the male is the coronal sulcus. In the female Fournier reports the following distribution of chancre:

Location	Cases
Greater lips	114
Lesser lips	55
Fourchette	38
Cervix	13
Introitus vaginæ	9
Urinary meatus	17
Superior vulvar commissure	2
Vagina	1

Several clinical types of chancre have been described such as erosive, ulcerative and papular, all having certain characteristics in common. They are usually painless, indurated, ulcerated, and exude a serous fluid. In size they vary from three millimeters to nearly two centimeters in diameter. A chancre may be absolutely atypical and last but a day or two and the patient not be aware of it, and again it may persist until after the appearance of secondary lesions. A point

that can not be too strongly emphasized is that all genital sores are regarded as potential chancres until proved otherwise. There is usually a bilateral inguinal adenitis, which does not suppurate. A mixed infection may be present, *i.e.*, chancre and chancroid and the diagnosis of chancroid does not necessarily rule out the diagnosis of chancre.

The diagnosis of chancre is made first from the history, second from the clinical findings, and third and most important from the laboratory findings. The indurated sores located at the coronal sulcus or at either side of the frenum, which produces a characteristic "flop" when the foreskin is retracted, or which produce an irretractable phimosis and bilateral inguinal adenitis, do not escape diagnosis by the trained observer, but the atypical ones can only be diagnosed by the laboratory aids. The dark field illuminator reigns supreme for this diagnosis and the practitioner who fails to have all suspicious lesions examined by this method is guilty of moral malpractice. The sore should be carefully cleansed with normal salt solution, and in those cases where some local caustic has been applied, a continuous wet salt solution dressing should be applied. Some of the serous fluid is expressed from the ulcer and drawn up in a papillary pipette, care being taken to exclude the blood. This examination if carefully performed should yield ninety-five to one hundred per cent. positive findings in untreated chancre. The findings are less constant as the duration of the lesion increases. In suspected cases, the examination should be repeated on successive days, especially in those cases where caustics have been employed. The finding of a single *Treponema pallidum* is pathognomonic.

Puncture of the inguinal lymph nodes and demonstration of *Treponema pallidum* by the dark field has been employed in those cases where the use of caustics has rendered the direct examination negative.

It is well known that the application of various antiseptics and mercurials such as calomel powder and ointment, blue stone, etc., destroy the treponemata on the surface and render the dark field examination negative until they have been removed several days. In an attempt to make the diagnosis as early as possible, Baeslack and Keane suggested that tre-

ponema could be demonstrated by culture. Our findings would indicate that while the method is easy to employ, the patients resent a section being taken and the low percentage of positive results make the procedure of questionable value.

The patient's blood should be subjected to the Wassermann reaction—even should the diagnosis of chancre be established by the dark field, because a negative reaction should offer a better prognosis.

The Wassermann results in the initial stage of syphilis as given by Craig are as follows:

Week after appearance of chancre	Total number examined	Total positive reactions	Per cent. positive
First	65	10	27.6
Second	122	62	50.8
Third	123	79	64.2
Fourth	134	98	73.1
Fifth	39	31	79.4

Thus it will be seen there is a gradually increasing curve up to the sixth week, or advent of the secondary lesions, when the Wassermann reaction should be one hundred per cent. positive. Therefore, passively to await the advent of secondaries to confirm the diagnosis should be sufficient ground for a suit for malpractice.

A reliable laboratory should be picked out for the performance of the Wassermann reaction—preferably one connected with a hospital. A trained worker, who is given neither to fads nor short cuts nor modifications, is indispensable. The experienced clinician will desire to know what method is employed and what antigens are used, for some are more sensitive than others and may be therefore liable to false positives. We believe it is better to miss an occasional case of syphilis with a not too-sensitive antigen, rather than one that is liable to give false positives and thereby brand an innocent individual as a syphilitic.

Treatment. Syphilis from its conception is a constitutional or tissue disease and the treatment should be given as early as possible. The sheet anchor in the treatment of syphilis is no longer mercury, but arsphenamin or its substitutes. It is of paramount importance, however, that the injections of arsphenamin in the beginning be administered as early as possible and intensively in full doses commensurate with the phy-

biological tolerance of the patient, not scattered indefinitely over months, interspersed here and there with a Wassermann test. In view of the possibility of immediate cure by this drug, properly administered in the primary if not in the secondary and latent stages of the disease, the treatment of syphilis, particularly in the chancre period, prior to the advent of a positive Wassermann, becomes an emergency operation in many instances, no less imperative than appendectomy. Our experience dictates as a reliable routine in the chancre stage, before the Wassermann becomes positive, to give a series of from four to six injections of full size dosage if the patient's condition warrants, once a week or every five days. If the serological test is positive the full size injections are given in weekly intervals for six weeks and then a rest period for three weeks followed by a Wassermann test. If this be positive another series is given until it becomes negative. The patient is then advised to have the test repeated every three months the first year, every six months the second year, and yearly thereafter. An individual whose blood has been positive is advised to have a spinal puncture and the spinal fluid subjected to all the routine examinations after the blood becomes negative.

The patient should have a careful physical examination before the administration of intravenous medication and the urine examined before and after each injection.

Mercury in one of its various forms is used by many, in conjunction with the arsphenamin treatment, but we rarely employ it in the primary stage. In the later stages it is most useful, but in the primary stage the patient has all he can handle with the full size injection once a week. After the course of arsphenamin injections, mercury should be pushed to the physiological limit and the patient kept on it steadily with rest periods for a year. After that it is advised in a six weeks course every fall and spring. There is no advantage in giving the iodides in the primary stage.

Owing to the fact that the organisms have already spread beyond the initial lesion as soon as it makes its appearance, there is no advantage in excising the chancre as has been advocated. Local treatment should consist in the application of a dusting powder of calomel, with due precautions against the disease spreading further.

Except in the early stages of syphilis, there is no assurance that treatment effects an absolute cure; it may simply render the disease latent. Clinical and serological cures may not be cures at all, as shown by Warthin and others in demonstrating the treponemata at autopsy in the heart and vascular walls of supposedly cured syphilitics. The fate of the syphilitic is directly dependent upon the earliness of the diagnosis and the intensity of treatment during the first few weeks or months of the infection. If after two years the Wassermann is negative and there have been no symptoms, the patient is regarded as clinically cured, but this is by no means an absolute proof that the disease is eradicated. The growing list of reinfections following intensive treatment is the best indication that some of the cases must be cured. We recently observed a reinfection within four months. A syphilitic is not permitted to marry until the Wassermann reaction has been continuously negative for two years with no symptoms.

In spite of all the propaganda for an early diagnosis, we see but a small percentage of patients in the primary stage, and this is because the patient often attempts to treat himself, assisted by the corner drug store or quack remedy, and too often because the physician either does not have the means at his disposal to make an early diagnosis or rests content until the Wassermann becomes positive or secondaries appear.

It is difficult to impress upon the patient the seriousness of the disease and get full coöperation for a longer period than he has actual subjective symptoms. In an analysis of over five hundred cases, we found that only five per cent. returned until they were declared cured. The social service department forms a valuable adjunct in treating these cases in the hospital and while private patients are supposed to have enough intelligence to heed advice, too often it is not the case.

CHANCROID.

Chancroid has been variously named soft chancre, simple chancre, and non-infecting sore, and is a contagious venereal ulcer. In certain localities and in hospital practice especially, chancroids are more frequently encountered than chancres, but

among private patients, whose personal hygiene is better, chancres are more common.

Infection may occur at any age but is most common in the decades when promiscuous sexual intercourse is practiced.

There is no distinct period of incubation, being between three and five days or longer. The infecting organism is known as the bacillus of Ducrey. The lesions are inflammatory and destructive in type and frequently accompanied by a unilateral suppurating bubo. It is a local and not a constitutional disease.

The chancroid may be located upon any mucous or cutaneous surface about the genitalia. Extragenital chancroid is much less common than extragenital chancre. The shape of the lesion depends to a large extent upon the shape of the eroded surface through which the inoculation takes place.

The treatment is cleanliness and antiseptic washes. Crystals of argyrol have proven of value in the mild cases. In the rapidly destructive or phagedenic type, the ulcer is painted with a solution of cocaine 10 per cent., followed by 25 per cent. solution of cupric sulphate freely applied and the Oudin current applied through the vacuum electrode till the whole surface is turned a dark gray green. It is of the utmost importance that the current be carried to the deepest crypts of the ulcer and beneath the overhanging edges, otherwise the treatment fails. Usually within two days chancroids so treated are converted into clear granulating ulcers.

The prognosis is therefore good and unless the destructive area has been considerable, the patient suffers no aftermath.

The great danger is that the lesion may be a mixed infection—both chancroid and chancre and the chancre may be overlooked until secondary lesions appear. The dictum that all genital sores should be regarded as chancres until proved otherwise should be strictly observed. Weekly blood examinations should be made until the period of incubation for syphilis has passed beyond the secondary stage.

Gynæcology

BY

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Gynæcology.

WHAT is "middle age" in the female? From the standpoint of the gynæcologist, the female ceases to be a woman at the age of forty-five, or thereabouts. A man of that age is in the prime of life and does not begin to be really old for another ten years. With woman, it is different. The male may, and often does, procreate until he reaches sixty-five or seventy but his consort may be said to cease to be fertile by her forty-fifth year, and so must then be classed, physiologically, as an old woman. In this article, however, she will be given the full benefit and the diseases of the female generative organs most frequently met with between the ages of thirty-five and forty-five will be dealt with.

MENOPAUSE.

The period of transition from active sexual life to physiological old age in woman is variously termed the "Menopause," "Climacteric" or "Change of Life" and includes the time between the beginning of menstrual irregularity to her complete restoration to health. The age at which this occurs depends upon various factors, such as the physiological activity of the sexual organs, climate, the woman's general health, neuropathic influences and heredity, daughters frequently following in the footsteps of their mothers. The writer knows of one case where four sisters married and had families, yet in each case the menopause was fully established at the age of thirty. In temperate climates, the woman begins to have symptoms of the change in her forty-second or forty-third year and the process is completed in between two and three years, but when menstruation begins early, thus giving evidence of hyper-activity of the sexual organs, it may not terminate until the fiftieth year of age, or even later. Menstrual life is also prolonged in married women who have borne a moderate number of children, and

in certain diseased conditions of the uterus or appendages. The duration of the symptoms varies from one to four or five years and their intensity is by no means uniform, a menopause induced by operation, *i.e.*, removal of the appendages, being shorter and more violent than one which comes on naturally.

Causes. The normal menopause is produced by the removal of the influence of the internal secretion of the ovaries. That this period is not always accompanied or preceded by cessation of ovulation is proved by the fact that very occasionally pregnancy occurs months after the apparent conclusion of the climacteric changes.

Pathologically, the menopause may be caused by the removal of the appendages, although this is not always followed by the immediate cessation of menstruation, by shock, nervous strain, neuropathic changes in the central nervous system or acute or exhausting diseases, such as typhoid fever or tuberculosis.

Symptoms. These vary in intensity and variety with the cause and with the individuality of the woman. Normally, the amount of the flow becomes less and less and the intervals between the periods increase in length until finally nothing more is seen. Even a pre-existing leucorrhœal discharge tends to lessen or even disappear. In some instances, the menopause is ushered in by more or less profuse hæmorrhages from the uterus, either during or between the periods. These must be thoroughly investigated, owing to the liability of women of this age to cancer. This is most important to remember as many women are condemned to an early and painful death through failure to distinguish the existence of this dread malady. Every menstrual irregularity, during the menopause, must be carefully considered and cancer excluded before deciding upon any line of treatment. At the same time, the woman suffers from vasomotor disturbances, evidenced by sudden rushes of blood to the head, causing temporary redness of the face, the so-called "hot flushes," followed by a chilly sensation, as the blood recedes to the internal organs. These gradually become less and less until they finally cease. Few escape as easily as this, however, especially when caused by abnormal

circumstances or conditions, as after double oöphorectomy during active sexual life. In addition to these flushes, the woman may have vicarious menstrual discharge from the nose, lungs, bowels or kidneys, which fact should be borne in mind when called upon to treat hæmaturia in women who have reached the menopausal age. The lungs are apt to be congested, causing a form of bronchitis. Catarrh of the bowels or stomach may be seen. Many women at this time are especially prone to headache, and in some cases the mind is actually affected, either permanently or temporarily. Most women become more melancholic or morose than normally. An excessive deposit of adipose tissue in the omentum and abdominal walls is usually observed, frequently causing the patient to complain of pain in the back, due to excessive weight of the abdominal wall, and an increase in the amount of hair on the face may be seen. Occasionally, the voice assumes a more or less masculine type. An abnormal sexual desire is sometimes experienced by women just previous to or during the menopause, as if the ovaries realised that their time was short and were making a last effort to produce another pregnancy.

Treatment. This may be preventive or palliative, but is chiefly the latter. In performing hysterectomy for fibroid tumours of the uterus, one or both ovaries should be left if possible. When this is not advisable and they have to be removed with the growth, one may be implanted in the broad ligament, splitting this and embedding the ovary between the layers, or it may be placed in the substance of one of the recti muscles. The latter situation is preferable, as the organ is better nourished and therefore retains its activity longer. Ovaries so treated may live for some years and favour the occurrence of a normal menopause.

A. G. Hulett (Medical Record, Aug., 1921), after a double oöphorectomy, gives five grains of ovarian substance four times daily for one month, beginning the treatment five days after operation. During the second and third months, he gives a similar dose three times a day. In the next three months, three grains three times a day are administered and in the seventh and eighth months, the woman receives three grains twice daily. During the ninth month, the dose is

lessened to two grains twice a day. In the tenth month, the dose is two grains each night, in the eleventh it is two grains every alternate night and for the final, twelfth, month the patient is given two grains every fourth night. By this means, he hopes to lessen the woman's liability to disagreeable symptoms by the gradual reduction of the amount of the ovarian hormone in the blood. Others are satisfied to allow the flushes and other symptoms to appear and to keep them in check by the administration of five grains of ovarian extract, or substance, alone or combined with the extract of the pituitary or thyroid glands. It is seldom that the exhibition of five grains of "Varium" thrice daily for a few days will not cause the cessation of the symptoms each time that they occur, until they finally disappear. A similar course of treatment will be found to be beneficial during a normal menopause.

In addition to the above, the general health of the patient will require attention. Nerve tonics will be found useful. The woman ought to have as much fresh air as possible and it is well to advise change of scene and surroundings. Her diet ought to be of a plain but nourishing description and alcohol should be used sparingly. Every effort should be made to render the patient's life as smooth and free from worry as possible during this critical period as her happiness and utility during the remainder of her life are largely dependent upon the successful weathering of the storms of the menopause.

HÆMORRHAGE.

Hæmorrhage is only a symptom but is one of such importance as to deserve a chapter to itself. Ordinarily, a woman during the period of sexual activity, has a discharge of blood from the uterus every twenty-eight days. This is physiological and its absence, except during pregnancy, is abnormal. There are, however, various pathological conditions giving rise to genital hæmorrhage which call for special and careful study, as the time of the appearance of the flow, its manner of appearance and the character of the blood lost will be of material value in coming to a decision as to the malady from which the patient is suffering.

A woman who has given birth to many children will frequently have a varicose condition of the veins of the vagina or vulva. These may rupture spontaneously or be lacerated by trauma, causing more or less loss of blood. Inspection of the genitalia will reveal the source of the bleeding, which may be checked by pressure of a pad and bandage or it may be necessary to ligate the vessel.

Laceration of the cervix or perineum during labour not infrequently occurs and is characterised by a sudden flow of bright red blood but the vessels soon contract sufficiently to allow of clotting and thrombosis of the blood with a consequent cessation of the bleeding. Inspection of the cervix and perineum will expose the bleeding points which may require to be closed by ligature or stitch.

When the patient is pregnant, a low implantation of the placenta will produce a flow of blood by separation from the uterine wall. This hæmorrhage is slight and intermittent until the later stages when it may be so profuse as to endanger the woman's life. In case of slight bleeding every effort should be made to check it and to carry the woman along until, at least, there is a chance of her giving birth to a living child. This may be done by absolute rest in bed on a comparatively low diet together with the use of some sedative to steady the circulation. One of the best drugs for this purpose is heroin, giving it in doses of $\frac{1}{10}$ grain hypodermically as required. Some use morphine but heroin is better as it has no deleterious effect upon the foetus. When the bleeding occurs at full term, and is very profuse, the woman should be delivered at once by perforating the membranes, or even the placenta, turning the child and bringing down one leg to plug the cervical canal and produce pressure on the bleeding vessels. Accouchement forcée, with complete and rapid emptying of the uterus will be required at times, owing to the severity of the hæmorrhage.

Carcinoma of the uterus, either of cervix or fundus, causes uterine hæmorrhage. In this case, the bleeding is caused by erosion of the vessel wall, consequently the blood appears suddenly and is bright red in colour. It continues until the whole calibre of the vessel wall has been destroyed, at which time the coats of the vessel contract and close the opening

so that the hæmorrhage is arrested. Sooner or later this hæmorrhagic discharge assumes an extremely offensive odour. The sudden onset and cessation and the bright colour of the blood help to distinguish this form of hæmorrhage from some of the others.

An altogether different picture is seen in bleeding caused by a sub-mucous fibroid. In this case, the bleeding is caused by the increased congestion of the endometrium, therefore it first appears as an augmentation of the ordinary menstrual flow, coming on and ceasing gradually, and the blood is dark red in colour. Only in very exceptional circumstances does this discharge become foul, although it not infrequently has a heavy odour but not in the least comparable to that of carcinoma. Chronic metritis or endometritis is often the cause of uterine bleeding, usually in the form of menorrhagæa. The blood is dark and tends to clot. Local examination reveals a hard cervix with an enlarged, hard fundus.

Certain diseases of the appendages, such as ovarian tumours or inflammation, especially if acute, may be accompanied by hæmorrhage, in which case, the history of the patient and the result of the local examination will at once show the cause.

Extra-uterine gestation before rupture of the sac, frequently gives rise to a form of uterine hæmorrhage which is almost typical. The bleeding appears, either with or without previous amenorrhœa, as a slight stain or small flow and this continues each day in such small amount that the woman often complains of it as a "dribbling." Where this condition is present, there will be a steady pain in the affected side, this pain gradually but steadily increasing in severity.

Disease of the heart, kidneys or liver must be excluded, as any obstruction to the circulation tends to engorgement of the endometrium with a consequent discharge of blood from the uterus. Most of the above conditions will be considered under the various headings but one cannot be too insistent upon the absolute necessity of making a diagnosis by careful local examination in all cases of uterine bleeding.

PRURITUS VULVÆ.

Irritation or itching of the external genitalia is likewise but a local manifestation that some pathological condition is present and its etiology is at times difficult to discover. An abnormal condition of the blood may produce intense irritation of the vulva, as where it contains an excess of bile, sugar or uric acid or some drug, as for example alcohol, iodine, cantharides or any opium preparation. Anything causing congestion of the vulva will cause it, pruritus occurring not infrequently in pregnancy, displacements of the uterus or tumours of that organ. Just as elsewhere in the body, skin diseases may set up itching, or abnormal discharges from the vagina or uterus, as in carcinoma. An extremely common cause is the presence of parasites, as pediculi, or want of ordinary cleanliness.

Pruritus is more troublesome during the night or while menstruating, due to stagnation of the circulation and increased warmth of the parts.

Examination of the genitals locally will reveal the cause in those cases due to want of cleanliness, irritating uterine discharges or pediculi. The skin will usually be red and hyperæmic, due partly to the disease and increased by scratching. It may even be actually broken down in places. In other women, nothing at all is to be observed, in which case it will be found to be purely a nervous manifestation and examination of particles of skin under the microscope will show the sensory nerve terminals to be increased in number and size.

The *treatment* will depend upon the cause which should be carefully sought, but even where due to some systemic disturbance local attention is necessary for the patient's comfort. The latter object is sought by directing the woman to practise scrupulous cleanliness, washing the parts with warm water and pure castile soap or with pure olive oil, omitting the water entirely. Various sedative lotions or ointments may be tried. There is no specific, but one drug after another must be tried until some combination is found which will relieve a given case. At times, simply bathing the parts with a solution of boracic acid, one drachm to the

quart of warm water, drying the area gently with absorbent cotton or soft linen and then covering it with dry boracic powder will give great relief, keeping the labia separated by a thin pad of absorbent cotton. This treatment ought to be repeated every time the woman passes water, so as to remove every trace of urine, even when this is not the causative factor in the case. At other times, replacing the boric solution with one of carbolic acid, one in forty or even one in twenty, will be better, the carbolic having an anæsthetic action on the skin. When the parts are moist, they must be kept dry and either some dry powder or oleagineous preparation be applied. A numbing of the tissues may be produced by either intense heat or cold, by means of hot cloths or an ice-bag or an evaporating lead lotion, the effect of the latter being enhanced by the addition of tinct: opii to the solution or on the cloths. Painting the surface with silver nitrate, 20 or 30 grains to each ounce, sometimes gives relief, or tinct:iodi may be used instead. In very severe cases, it may be necessary to employ an ointment of cocaine of a strength of twenty per cent. Again, a mixture of black wash and bismuth will be useful as a local application. However, almost the whole pharmacopœia has been tried with varying success and the cause simply must be found and treated.

Where there is an irritating uterine discharge, vaginal douches either of plain sterile water or some mild antiseptic will be beneficial. If formaline is used, however, it must not be stronger than 1:5000, as it is very irritating to many mucous membranes. When of nervous origin, Faradism, X-rays, etc., may be tried or, in very obstinate cases, complete excision of the affected skin or mucous membrane will be required, cutting wide of the diseased tissues.

ESTHIOMÈNE.

Esthiomène is a condition of the vulva of undoubted syphilitic origin, the Wassermann test giving a positive reaction in almost every case. It is occasionally spoken of as a "rodent ulcer" but it cannot be said to be a true malignant form of disease, nor has the tubercle bacillus ever been

demonstrated in any of the cases examined for that organism. The disease is rare and is usually seen in prostitutes, or, at all events, in people of low vitality.

In the early stages, nodules form in the vulvar tissues. These enlarge and the tissues between them break down, forming ulcerated patches, which, in turn, give rise to fistulous tracts burrowing and running through the tissues, which may be actually honey-combed with them. The disease may be present for a considerable time before giving rise to symptoms sufficiently marked to induce the woman to seek advice. When they do occur, the patient complains of an itching or burning and, sometimes, of actual pain. The inguinal glands frequently become enlarged and painful due to an extension of the disease.

For *treatment*, the first essential is to keep the parts as clean as possible and they should be dusted with a mercurial powder or anointed with an ointment containing the same drug. In addition, the ordinary anti-luetic treatment should be followed. It may be necessary to remove the diseased vulva by operative measures but usually the above will suffice to effect a cure.

The prognosis is, as a rule, favorable, but death does now and then occur from exhaustion brought about by the discharges.

TUBERCULOSIS VULVÆ.

Tuberculosis may affect the vulva, just as other parts of the body, but is very rare and almost never primary, there usually being lesions elsewhere, as in the lungs.

Any part of the external genitals may be attacked, it first appearing as small, hard, multiple nodules, which ultimately break down and form ulcers with hard serpiginous margins and which spread very slowly. The surface is of a yellowish-red colour and emits a thin, pustular discharge. The growth bleeds on slight irritation. (Fig. 1.)

While the tuberculous process may affect the very young, it is more apt to attack those of more mature years, the women being usually between twenty-five and forty years of age.

In treating this condition, one should attempt to improve the victim's general health, just as is done in tuberculosis of any other part. In mild cases, the local application of iodoform powder or ointment will improve the condition. X-rays and radium have been used with benefit but complete excision of the affected areas will usually be required.



Fig. 1.—Tuberculosis of urethra. (Private collection.)

TUMOURS OF THE VULVA.

With the exception of cysts, tumour formation of the vulva is extremely rare, but one does find Elephantiasis, Fibroids, Sarcomata, Cysts, and Carcinomata. In addition, prominence of the labia may be caused by a descent of bowel or omentum, or even an ovary, through the inguinal canal.

Elephantiasis. This is a swelling of the labium caused either by syphilis or infection by the *filaria sanguinis*, and is much more common in the tropics than in colder countries. It consists of an œdema and hypertrophy of the tissues.

Uncleanliness favours the occurrence of the disease and it may follow, or be accompanied by, an attack of erysipelas.

Any symptoms to which it gives rise are due chiefly to mechanical irritation and walking and sexual intercourse are interfered with by the presence of the mass of hardened tissue suspended between the legs.

On inspection, the diseased parts will be seen to be en-



Fig. 2.—Melanotic sarcoma of clitoris. (Private collection.)

larged, and pigmented with, at times, actual excoriations. An offensive discharge of a serous nature may be present.

The treatment is extremely unsatisfactory unless the disease is confined to the actual labia, majora or minora, in which case wide excision is indicated.

Fibroma. This growth is rare and chiefly affects the labia majora, its structure being similar to fibroids in other parts of the body. The only symptoms are those caused by the discomfort produced by the presence of a mass in the vulva, the treatment being removal.

Sarcoma. This is the rarest form of tumour of the vulva and usually attacks the labia majora but may occur in any

of the parts around the vaginal orifice. The only case seen by the author was one of the melanotic variety affecting the clitoris. It first appears as a hard nodule but increases in size very rapidly. The prognosis is extremely bad, death usually resulting in a short time from the occurrence of metastases in other parts of the body. If seen in time, complete and wide excision is to be carried out. An absolute diagnosis can only be made by the microscope but where at all suspicious as to the nature of a vulvar growth it is better to remove it at once. (Fig. 2.)

Cysts. Cystic formation in the vulva is due either to blocking of the duct of a sebaceous gland or of the gland of Bartholini or else to a congenital condition.

A labial cyst may be mistaken for a soft myomatous tumour, a lipoma or an hernia. A diagnosis between the cyst and the two former conditions is usually readily made by the tense condition of the cyst with its clearly defined walls, while the hernia has the usual signs of that condition, *viz.*, an impulse on coughing and the extension of the neck up into the inguinal canal. If an ovary forms the body of the hernia, pressure will give rise to the sickening pain one produces by pressure upon that structure per vaginam.

The only treatment is excision, and in the removal every care should be made not to rupture the cyst during the operation as none of the wall ought to be left.

These cysts, especially of the Bartholinian gland, are very prone to become infected, in which case they present all the signs and symptoms of an abscess, which should be treated by incision and drainage just as elsewhere.

Carcinoma. Cancer of the vulva is really a disease more of old than middle age, most cases being seen in women between sixty and seventy years of age, but it does occasionally occur in those who are younger. When primary, it is of the squamous variety, but it may spread downwards from the cervix, in which case it may be of the glandular type.

It affects the sulcus between the two labia or else around the orifice of the urethra, appearing first as a small hard nodule, which ultimately breaks down and ulcerates, the surface of these ulcerations being granular and bleeding

easily on irritation. On account of the close apposition of the two labia, it not infrequently happens that a secondary growth is set up by contact.

The patient will first complain of itching of the affected region but this becomes infected when the surface breaks down and then there is constant pain. At first there is a serous discharge which soon becomes tinged with blood and before very long is very malodorous. When the disease has become definitely established, it will not be long before the usual cachexia and anæmia are observed.

When seen early, complete removal of the growth, together with a wide collar of healthy tissue, may effect a cure and the prognosis is rendered more favourable by the subsequent use of radium. If there is any enlargement of the inguinal glands they ought to be removed at the same time as the actual external disease.

In the later stages, radium or the X-rays will sometimes improve the condition temporarily but will not cure it. When no operation is indicated, on account of extension of the disease, the application of a strong solution of iodine every second day for three or four treatments will clean up the parts and tend to check both the discharge and hæmorrhage.

INJURIES FROM CHILD-BIRTH.

The passage of the full term fœtus down from the uterus through the cervix and vagina to the exterior is very liable to occasion certain injuries to the walls of the canals through which it descends. Even the uterus itself is not exempt from injury where there is a disproportion between the size of child and of the bony pelvis, so that one may have a ruptured uterus or a laceration of the vagina, cervix or perineum.

Rupture of the uterus during delivery belongs more to obstetrics than to gynæcology. It is caused most often by meddlesome midwifery, as by efforts at too speedy delivery before the external os is fully dilated or to rough and careless manipulation with the hand in utero in trying to turn the fœtus. It may, however, be caused by the efforts of a thin walled uterus to drive the fœtus through a canal which is too small.

When this condition occurs, the patient will complain of a sudden, sharp pain, followed by a cessation of uterine contractions and recession of the head from the pelvis. Palpation of the abdomen will reveal the foetal parts lying immediately beneath the abdominal wall, and the woman will exhibit the usual signs and symptoms of shock.

The only treatment is to open the abdomen immediately, stop the hæmorrhage and deliver the foetus, tying and cutting the cord. If the laceration in the uterine wall is not extensive, it may be closed by interrupted sutures of catgut running through the whole thickness of the uterine wall, great care being taken to invert the edges of the peritoneal covering of the uterus. It is seldom that it is necessary to remove the uterus but the operator must be prepared to perform the major operation if required. Whatever is done must be done quickly and the patient placed in bed, with hot bottles or electric pads around her, as soon as possible.

Laceration of the Cervix. The cervix is more or less torn in almost every delivery of a full term child. It may give way on one side only or right through from side to side. Now and then, there are several lacerations which radiate out from the canal, forming the "stellate laceration."

The symptoms of a torn cervix are pelvic pain and leucorrhœa, although—where it is extensive—miscarriage or premature labour may be caused by lack of support for the foetal membranes. The pain is caused by the inclusion in the cicatrix of some nerve filament, and is of the character of a dull ache in one or other iliac region. Absorption through the uterus, on account of the unhealthy condition produced by the irritation of the scar tissue, has been known to cause neuralgic pains in distant parts of the body. The leucorrhœa results from the chronic inflammation of the lining of the cervix or uterus, also as a result of irritation.

On making a local examination, the finger will feel the lacerations and the cervix will be felt to be enlarged and hard, while the mucosa covering it may be soft and velvety. When the cervix is exposed by means of a speculum, the actual tears will be seen and the cervical lips will probably be everted. The cervical mucosa is often seen to be red and inflamed and a glary discharge pours from the external os.

Owing to the chronic inflammation of the whole tissues of the cervix, the openings of the Nabothian glands will have become obstructed, giving rise to small cysts which appear as pearly white nodules beneath the mucosa.

With regard to *treatment*, if the laceration is small and there is but little evidence of inflammation, no treatment will be required unless it is a few applications of tincture iodi with the use of boro-glyceride tampons and hot douches. To be efficacious, this treatment must be administered three times a week, except during the menstrual periods, and the douches must be taken in the recumbent position. When at all extensive, however, especially if the woman is approaching the menopause, operation is indicated after a course of the above mentioned local treatment to reduce the congestion. The methods of repairing a laceration of the cervix are too well known to require any description here, but one cannot be too careful to avoid any diminution in the calibre of the cervical canal. For this reason, the sutures should pierce the cervical tissues at the junction of the mucosa lining the cervix with the raw area formed by the removal of the scar tissue. In addition, it is well to wait until the completion of the operation to give an intra-uterine douche and also to leave a narrow strip of gauze in the cervical canal for at least two days. Finally one must be careful to remove the whole of the scar tissue at the angle of the tear in order to cure the pelvic pain which is so often present in these cases.

Lacerated Perineum. Perineal tears are practically always caused during the delivery of a full term child but, in very rare instances, have been known to result from a fall or a brutal assault. They are classified as Complete, where the whole perineum into the rectum is torn, or Incomplete when the laceration stops short of the bowel.

The symptoms accompanying an incomplete tear are due more to the loss of support of neighboring structures than to the tear itself. As the chief support of the bladder and rectum have been removed, bulging of the wall of either the bladder or rectum, or both, down into the vagina is met with, the former being spoken of as "cystocele" and the latter as "rectocele." In both conditions, the patient complains of

the discomfort caused by the mechanical irritation produced by the prolapse of the vaginal walls. In addition, in cystocele, the patient's inability to completely empty the bladder produces a constant desire to micturate and favours the occurrence of infection with a consequent cystitis. At times, the dragging on the orifice of the urethra prevents control, thus allowing the urine to constantly dribble away, keeping the woman wet and uncomfortable. Rectocele produces a similar effect, in that the patient is often unable to completely empty the rectum without supporting its walls by pressure through the vagina. If the descent of the vaginal walls is extensive, they become irritated and inflamed, actual ulceration taking place at times.

Even where the laceration extends through into the rectum, the uterus may not descend, thus proving that it is not entirely supported by the perineum, but the patient will, nevertheless, complain of a "down-bearing pain," due to the dragging of the prolapsed wall.

In the complete variety, the patient loses control of the bowel, in addition to the symptoms described above, but when only a few fibres of the anal sphincter have given way, the bowel action may be regulated unless the contents are thin and watery.

The *treatment* consists of operation, but any co-existing inflammation of the vaginal mucosa must first be treated by rest and the use of iodine, douching and tamponade.

For the cystocele, the indication is to lessen the lateral area of the anterior vaginal wall. This is best secured by the removal of an elliptical shaped flap of mucous membrane, beginning just above the urethral orifice and continuing the incisions well down on the anterior face of the cervix. This denuded area is closed over by a continuous catgut suture introduced through the vaginal mucosa well to the outer side of the cut margin. The suture is carried as deeply into the tissues as possible without entering the bladder and then up through the tissues of the opposite side in a similar manner.

For the posterior wall, a similar principle, *viz.*, removal of scar tissue with union of the underlying muscles and fascia, is to be carried out. In some cases, exposure of the parts

will reveal one sulcus spreading from one side of the vagina to the other. In such conditions, a triangular area is to be denuded, grasping with a tenaculum forceps the centre of the vaginal wall as high up as may be thought desirable and the vulva can be held apart by a pair of similar forceps placed at the level of the last caruncle myrtiliformes, as these will mark the spot to which the tissues retracted when torn through. In some cases, however, it will be well to ignore the latter and to make the base of the triangle longer or shorter as may be required. It is well to begin the dissection at the apex of the triangle in the centre of the vagina and to roll the mucosa down on the tip of the finger as one proceeds, as by so doing one is less likely to perforate the rectum or leave islets of mucosa. Of course the lateral sides of the triangle ought to be marked out by fairly deep incisions before the denudation is begun. The field of operation is then to be closed by a continuous catgut suture from the apex down, inserting the needle well to the outer side of the divided mucosa as deeply into the tissues as possible in order to bring together the muscular fibres. When the wider part of the triangle is reached, the needle is to be passed through the tissues at the centre of the wound in order that as little potential space may be left as possible.

Where, on the other hand, there is a central rectocele or a bulging forwards of the central part of the vaginal wall, with a consequent sulcus or depression on each side, the denuded area is of a different shape. Here, each sulcus is to be denuded separately and its edges brought together with a continuous catgut suture but the outer side of each triangle must be carried right down to the perineum, the false mucosa between them removed and the wound closed by suture. Briefly, it may be said that an M-shaped area had been denuded and the edges brought together so as to form a cicatrix in the shape of a Y.

When the laceration has extended into the rectum, the divided ends of the sphincter are indicated by a slight depression on each side of the bowel, being connected by a stretch of puckered up tissue posteriorly, due to the contraction of the sphincter, and a perfectly smooth area, usually reddened, in front. The first step in the operation, is

to expose the ends of the sphincter by making a vertical incision over them, the centre of the incision running through the centre of the depression. Next split the margin of the diaphragm separating the vagina from the rectum, beginning in the centre of one of the primary vertical incisions and carrying this incision across to the centre of the other end of the sphincter. Dissect the vaginal mucosa from the rectal wall as high up as may be necessary. Where the actual rectal wall has been torn, the edges must be united by fine interrupted catgut sutures placed close together, and passed in such a manner that the rectal mucosa is not perforated. In a few hours, these mucosal edges are glued together by serum and the sutures are thus buried and safe from infection, whereas if they go through the rectal wall and the knots lie in the bowel, they act as guides along which infection is liable to travel with a consequent breaking down of the wound. After the rectal tear has been closed up, a silkworm-gut suture is passed through the skin just outside the centre of the end of one sphincter in such a manner that it will perforate the muscle. It is brought out between the vaginal and rectal flaps and across the wound. On the other side it is inserted in such a manner as to perforate the sphincter and emerge through the skin opposite to its entrance on the first side. A second, or stay suture, is passed external to the first and then both are tied. If the first stitch has been passed correctly, a finger passed into the rectum will be felt to be grasped equally tightly all around. The laceration has now been converted into one of the incomplete variety and is to be treated accordingly.

After the above various operations, the vagina is to be lightly packed with gauze, which may be left in place for two days.

A post-operative complication which is extremely likely to be met with in these cases, is inability to empty the bladder, catheterisation being usually necessary, but the patient may be consoled by the fact that this frequently occurs but disappears in a few days.

In the case of the complete laceration, the bowels ought to be locked up for five days, at the end of which time a dose of castor oil may be given and the effect aided by an

oil enema, but where the rectum has not been interfered with they may be opened as soon as the patient feels the desire.

UTERINE DISPLACEMENTS.

The uterus lies in the median line vertically in the pelvis in such a position that the tip of the cervix is on the level of a line drawn from the third sacral vertebra to just below the upper margin of the pubic bone. It normally has a considerable degree of mobility physiologically, depending upon respiration and the condition of the bladder and rectum.

The natural position of the uterus is one of slight ante-flexion, *i.e.*, the cervix and fundus approach each other to some extent in front, the cervix looking downwards and backwards while the fundus points in the opposite direction. The organ is retained in this position by intra-abdominal pressure, by ligaments, muscles and fascia of the blood vessels. The cervix is drawn backwards by the utero-sacral ligaments, while the fundus is held to the front by the intra-abdominal pressure of the intestines, aided to some extent by the round ligaments, while the broad and round ligaments prevent the organ falling to one side or the other. Any weakness in or destruction of one or other of these ligaments or muscles favours displacement of the organ, as does also the presence of any tumour or inflammatory mass within the pelvis.

Posterior Displacements. When the fundus lies posteriorly to the long axis of the patient's body with the cervix in front, the condition is spoken of as "retroversion," while where the fundus is at the back with the cervix maintaining its position, pointing downwards and backwards, it is said to be "retroflexed." Both having similar causes and symptoms will be considered together.

The posterior position of the fundus may be of congenital origin or it may occur secondarily, as the result of blows, falls or some pathological condition in the pelvis. It is frequently seen where the patient goes about too soon after delivery, the fundus then being heavy with a tendency to fall back on the slightest provocation, as is seen where the habitually distended bladder pushes the fundus backwards or a chronically full rectum presses the cervix forwards, thus tilting the fundus in the opposite direction. Tumours lying

between the bladder and fundus push the latter backwards, and it may be drawn in the same direction by adhesions between it and the posterior pelvic wall. A similar effect is produced by the presence of tumours in the posterior wall of the uterus weighing it downwards and backwards.

Pure, uncomplicated retroposition of the fundus gives rise to but slight *symptoms* if any, those which are observed in this condition being due more to a falling of the uterus than to the fundus being displaced backwards. A posteriorly displaced fundus frequently has, however, a marked effect on pregnancy in that it tends to prevent conception and, when that does occur, to cause a premature emptying of the uterus. This liability to abortion is due partly to increased congestion of the uterus and partly to the danger of the fundus being locked down below the promontory of the sacrum. The interference with the circulation of the uterus produces two symptoms, *viz.*: menorrhagœa and leucorrhœa. In an extreme degree of retrodisplacement where the uterus is hard and large, pressure of the fundus upon the rectum may have the effect of a ball-valve and so prevent the emptying of that viscus. In other cases, it has been known to induce a looseness of the bowels on account of the irritating pressure on its wall. Again, a hard, large cervix may press on the bladder or urethra in front inducing frequency of micturition, this being more marked during the day, *i.e.*, when the woman is in the erect position, than at night when she is reclining.

The only *treatment* is to replace the fundus and retain it in the normal position. In some cases, this may be effected by postural methods, having the woman assume the knee-chest position for some minutes once or twice a day, together with careful attention to the condition of the bladder and rectum. If the knee-chest position is attempted, the patient must be warned to have the thighs at right angles to the structure upon which she is kneeling, as, if the abdominal wall is allowed to rest upon them, the abdominal contents are supported and so do not allow the fundus to fall forward. As an assistance, the cervix may be caught by a tenaculum forceps and drawn towards the sacrum. When this fails, manual reposition should be tried. Placing the woman in either the Sim's or dorsal position, pass one

or two fingers into the vagina and press the fundus to the right of the sacrum and upwards at the same time. Then pass the index finger of the vaginal hand in front of the cervix and press it backwards. At the same time, the fingers of the other hand should be flexed on the lower abdomen to try and reach down behind the rising fundus which ought then to be lifted forwards by those fingers. When the uterus is not held in its abnormal position by adhesions, this is the best method of reposition, the use of instruments being dangerous. Once the fundus is in place, it may be retained there by either a pessary or some operative procedure. If a pessary is used, care must be exercised that the uterus really has resumed its normal position and that the instrument fits properly. If too large, it causes injurious pressure on the vaginal walls, while if not large enough it fails in its object. By wearing a pessary for one or two years, a cure will be produced in a small percentage of cases and it will always relieve the symptoms while in position. At all events, when a retroverted uterus is the seat of gestation and an abortion is threatened, the careful replacement of that organ and insertion of a well fitting pessary in the vagina will frequently allow the woman to go on to full term without further trouble.

Surgical interference is rarely necessary and will be considered when dealing with prolapse.

Prolapsus Uteri. This is the most important displacement of the uterus, as it always produces symptoms if at all extensive. In fact, one now and then runs across women who are made miserable by even a slight degree of prolapse.

Downward displacement of the uterus is classified as either Complete or Incomplete, the former receiving a special name, *vis.*: Procidentia. In complete prolapse, or procidentia, the whole uterus lies outside of the vulva, the vagina being more or less inverted. It usually results from a laceration of the perineum, especially if the woman has done hard work or undergone much strain in the upright position, and so is most frequently met with in middle-aged multiparæ. It does occur, however, in nulliparæ, where they have performed hard labour or when the uterus is heavy and its supports weak. The downward pressure of intra-abdominal tumours

will cause it, retroversion with prolapse being a common complication of such conditions.

With the uterus in its usual position, its long axis points almost directly backwards towards the sacrum and the organ is supported by all of the pelvic contents beneath it, *viz.*: the bladder, the vaginal walls, the perineum and the rectum. Pressure from above causes the uterus to slide downwards and backwards towards the sacrum. Where, however, the uterus is retroverted the long axis is the same as that of the vagina and pressure forces the uterus down along the vaginal canal.

The *symptoms* of prolapse, especially when complicated by retrodisplacement are very marked at times. The woman complains of pain in the lower part of the back over the sacrum, this pain being either a dull ache or acute and sharp. The latter is chiefly seen when the displacement is of an acute origin, as following a blow or fall. She also often describes the sensation as if everything was coming away, or as a "bearing-down" feeling. The pain may radiate out to one or other side or down the sciatic nerve, so-called sciatica being the only symptom. This is more likely to occur when the uterus is retroverted and the fundus contains a small fibroid tumour.

The menstrual periods are profuse and may be extremely painful, the pain preceding the flow by several days and lasting until menstruation ceases. As a rule there is a leucorrhœal discharge on account of the disturbance of the circulation causing congestion of the endometrium, the discharge being rather thick and of a dirty white colour. Mechanical irritation by pressure of the bladder or rectum may produce frequency of urination or defæcation.

Local examination in procidentia will show the whole uterus to be protruding from the vulva and palpation will reveal the presence of the uterine body in the sac, while the bladder will be felt in front. As the uterus has usually been in its abnormal situation for a considerable period of time, friction against the patient's clothes will probably have caused excoriation of the most dependant parts which will look red and inflamed.

In lesser degrees, the cervix will be low in the vagina and the fundus will be below its usual level. Unless held down by adhesions, both may be readily pushed up into their normal situation. In the case of an elongated cervix, with which a moderate amount of prolapse is often confused, the fundus is felt to be in its usual position, while the cervix cannot be elevated sufficiently to restore the fornices to their normal depth.

The *treatment* is directed towards replacement of the uterus and maintaining it in the correct position.

Where the whole uterus has been outside of the vulva for a considerable period of time, the irritation set up by the woman's clothes will have caused excoriation or ulceration of the exposed parts. In such a case, place the patient in bed and keep her there and try to reduce the inflammation by douches, the application of tincture iodi and the use of tampons. When the ulceration is healed, you may attack the displacement. As there will be but little support for a pessary, some form of plastic operation on the vaginal walls will be indicated but must be supplemented by one of the various methods of supporting the uterus from above, such as by extra or intra-abdominal shortening of the round ligaments, or suspension from, or fixation to, the anterior abdominal wall.

When operation is contraindicated for any reason, as by serious cardiac, kidney or lung disease, a ring pessary may possibly suffice, especially if the woman has remained in the recumbent position long enough to allow the vaginal walls to regain their tone but this is exceptional. If a ring cannot be retained, you may try a cup and stem pessary, supported by elastic bands attached to an abdominal belt. This cup and stem is the only pessary which a patient may be allowed to remove and replace herself. The others, Hodge or Albert Smith, may be taken out by the woman but if she attempts to put them back again, she is almost certain to fail to place them in the proper position, so that she will do herself actual harm. The cup pessary ought to be removed each night and placed in some mild antiseptic solution and reinserted in the morning before the patient leaves her bed. When the other instruments are used, they ought to be removed,

cleansed and replaced by either a doctor or nurse at least once every six weeks. If not, they will set up an irritation of the vaginal mucosa and may be actually embedded in the walls of the passage.

INFLAMMATORY AFFECTIONS.

Vaginitis. While inflammation of the vagina in the adult is usually either sub-acute or chronic, it may be acute. This latter is caused by infection, especially by the gonococcus, or by intensely irritating discharges, as in cancer of the cervix or, more rarely, of the fundus. The more chronic variety may result from any local hyperæmia, as that accompanying pregnancy, persistent irritation by uterine discharge, want of care when the patient is wearing a pessary, or by the entrance of worms over the perineum. The flow of the urine from the bladder in cases of vesico-vaginal fistula will set up an inflammation of the vaginal walls, and it frequently occurs as a result of acute infectious fevers, diphtheritic and other membranes forming on the vaginal mucosa at times.

In the acute form, the mucosa is red and inflamed in appearance. It is swollen, hot and tender and is covered with a thickish muco-purulent discharge.

When the sub-acute or chronic form is met with, examination of the vagina will show that its surface is covered with minute red spots from the papillæ being affected.

The *treatment* of acute vaginitis consists of rest in bed, low diet and the administration of saline aperients. If the parts are not too sensitive, vaginal douches will be useful. If the latter are used they should contain some mild antiseptic, such as boracic acid, or milk of magnesia may be added to the sterile water. The temperature of the solution ought not to be too high and they are to be given very gently, the solution can not being elevated more than three feet above the level of the patient. In addition to the above, one may insert daily into the vagina suppositories containing antiseptic and astringent drugs, as alum and ichthyol with cocoa butter as a base. Later on when the condition becomes less acute, or in chronic cases, the treatment may be

more energetic. The vaginal walls are now to be exposed and painted with a solution of silver nitrate, 60 grains to each ounce, or tincture iodi may be applied instead. A tampon saturated with a ten per cent solution of ichthyol in glycerine is to be inserted and its removal at the end of twenty-four or thirty-six hours followed by an astringent and antiseptic douche. In septic cases, the use of yeast is highly recommended, introducing into the vagina tampons containing powdered yeast and saturated with a solution of cane sugar or glucose. The yeast fungus multiplies and kills off all other germs which may be present. These tampons are left *in situ* for one day (twenty-four hours), when they are removed and a douche of warm sterile water given, this treatment being repeated at the end of another twenty-four hours.

Metritis and Endometritis. As inflammation of the mucous lining of the uterus practically never occurs without also affecting its muscular wall, and because their causes and symptoms are similar, the two conditions will be considered together.

Inflammation of the uterus may be acute or chronic, the latter usually following the acute, but at times occurring quite independent of it.

The *acute* is caused by infection, in connection with pregnancy as a rule, but it may result from the extension of the gonococcus up into its cavity from the lower passages. Unclean instrumentation is liable to cause this condition.

It is characterised by acute pain in the pelvis, usually in the median line, and tenderness over the fundus uteri. This will be accompanied by a profuse purulent discharge. Irritation of the bladder is usually present, manifesting itself by frequent and painful micturition. This is due, either to direct infection of the bladder by the germs entering along the urethra or to extension of the inflammatory process from the uterus. The patient suffers from chills, the temperature going to 102 or 103 degrees Fahrenheit, or even as high as 107 or 108 degrees. The pulse is rapid, 120 or more beats per minute. The skin may be bathed in perspiration or may be dry and hot. In the more severe cases, the bowels will

be distended, the tone of their muscular walls being lowered by the infection.

On making a bi-manual examination, the cervix will be found to be soft and the body of the uterus enlarged, tender and rather soft and its movement causes pain.

In the *treatment* of this condition, the first thing to do is to place the woman in the Fowler's position in order to favour drainage of the genital canal. Simple elevation of the head of the bed will not do; the patient must be almost sitting bolt upright and the thighs must be supported in some manner so as to make her comfortable and keep her from slipping. Where no real peritonitis bed is available, the Fowler's position may be obtained by placing a kitchen chair, resting on the edge of the seat and the back of the chair, underneath the upper end of the mattress which has been raised sufficiently for the purpose. Pillows beneath the knees will tend to prevent the woman from slipping down in the bed, or a sling composed of a bed-sheet passed under the thighs with its ends fastened to the top of the bed will serve one's purpose admirably. An ice-bag placed on the lower abdomen will give great relief and tend to prevent spreading of the inflammation. The use of hot antiseptic douches will prove a useful adjuvant in checking the extension of the trouble. The poison may be diluted by making the woman drink as much fluid as possible and by the use of normal saline per rectum or beneath the breasts. When resorting to the use of saline solution, its administration per rectum by the Murphy method, allowing it to enter the bowel drop by drop, will be found to be the most efficacious, as there is no irritation of the bowel. In addition to diluting the poison, this saline undoubtedly acts as a direct stimulant and its beneficial effect is early manifested in most cases. The patient's strength must be kept up by the use of heart tonics, such as strychnine, $\frac{1}{30}$ grain every four or six hours. The administration of alcohol, either as brandy or whiskey diluted with hot water, will sometimes act as no other drug will, by stimulating the circulation and producing a profuse diaphoresis.

At times, the wall of the uterus will be actually riddled with abscesses, suggesting the possibility of hysterectomy,

but this operation is not to be recommended in such cases, as the presence of these abscesses is extremely difficult to detect and when they are found the condition of the patient will be such as to make the prognosis of the operation almost hopeless.

The *chronic* form sometimes follows the acute, but not invariably, it coming on more gradually and insidiously, as the result of chronic congestion rather than infection. When a cervix is torn during labour and not repaired at once, or the attempt at repair is not successful, irritation of the uterine tissue is kept up, so that the organ does not involute properly, thus giving rise to chronic metritis. Excessive sexual intercourse or chronic constipation will act in a similar manner. The uterus becomes harder and larger than normal, due rather to the excessive formation of fibrous tissue than to an increase in its muscular elements.

The *symptoms* are a pain in the back, of a dull aching character, together with a feeling of weight in the pelvis, especially when the woman is on her feet. A more or less profuse leucorrhœal discharge is usually present. The flow at the menstrual periods is increased and there may be metrorrhagœa in addition. Sterility is frequently present as a result of the unhealthy condition of the endometrium.

On making a local examination of the pelvic organs, the cervix will be felt to be very hard and to contain small hard nodules which are seen as whitish elevations when exposed by a speculum. These are Nabothian follicles, formed as a result of obstruction of the cervical glands. The cervix is usually lacerated with a more or less gaping os and its surface is covered by a velvety mucosa. The fundus is enlarged, hard and usually displaced in some direction. The uterine body is not tender.

Treatment should be directed to the reduction of the congestion of the uterus. This may best be obtained by the use of copious warm douches, scarification of the cervix, the application of iodine and the use of boroglyceride tampons. The douche should consist of at least one gallon of warm solution, either sterile water, saline or mild antiseptic and, as it is the prolonged action of moist heat which is sought, ought to be given gently and slowly. After a course of this

preparatory treatment, any laceration present ought to be repaired and it will often be advisable to amputate a small portion of the cervix. It must be remembered, however that the uterus usually undergoes involution after an amputation of the cervix in such a case, so that one must be careful not to remove too much.

INFLAMMATION OF THE APPENDAGES.

Inflammation of the Fallopian tubes and ovaries is also due to either infection or chronic congestion and irritation.

Fallopian Tubes. The commonest cause of inflammation of the Fallopian tubes is infection by the gonococcus or some pathogenic organism, as the streptococcus or staphylococcus. It also results from tuberculosis or by infection by the colon bacillus extending from some of the neighbouring organs, it not infrequently being met with as a complication of appendicitis, where the appendix becomes attached to the tube and the bacilli travel through from the appendix. Infection may also spread to the tube from a diseased uterus. In tuberculosis, the infection is a descending one, the bacilli coming from either the lungs or intestine, it being rarely primary in the tube.

When the offending organism is the gonococcus, it ascends through the uterine canal, so that both tubes are usually affected. The pathogenic organisms, on the other hand, obtain entrance to either the blood-stream or lymphatics through a localized abrasion or breach of continuity of the tissues. Therefore they are prone to travel through the side on which the lesion has occurred and so that side is more liable to be affected than both, one tube being perhaps badly diseased while that of the opposite side is entirely unaffected. The relative frequency with which gonorrhœal salpingitis is bi-lateral while that due to pathogenic bacteria is uni-lateral forms a strong point in the differential diagnosis of the etiology of the case under consideration.

In addition to infection, salpingitis may be set up by chronic congestion of the pelvic organs as from too frequent sexual excitement, especially when ungratified, chronic constipation, sedentary occupation, etc.

This disease may be either acute or chronic, the former being always due to infection.

Symptoms of acute salpingitis are a sharp pain in the pelvis with elevation of temperature and increase in pulse-rate. The patient feels nauseated and may vomit. She frequently has a chill. The act of emptying the bowels or bladder may be painful on account of the proximity of the diseased organs. There may be a profuse vaginal discharge, examination of which reveals the presence of the gonococcus, in which case it will be thick, viscid and greenish in colour. Acute tenderness will be found over the diseased side or even all across the lower abdomen, the point of maximum tenderness being lower than McBurney's point, seen in appendicitis. The vagina will probably feel hot and a tender mass occupies one or other fornix, this mass being elongated or sausage shaped and probably fixed to the wall of the pelvis. An examination of the blood will show a marked leucocytosis, the white cells running up to twenty-five or thirty thousand.

The *treatment* of this condition is similar to that called for in acute metritis, *viz.*: absolute rest in bed in Fowler's position, ice applied to the lower abdomen, hot douches, stimulants and, possibly, a sedative for the pain, although this is usually relieved by the ice. The bowels should be emptied by a smart saline laxative and then kept at rest for a few days. The diet must be of the lightest variety consistent with the maintenance of the strength of the patient.

In the vast majority of cases, the above line of treatment will be successful in obtaining a complete cure, especially in those of venereal origin, so that operation should be delayed as long as possible. However, when the woman's condition does not show any signs of improvement but, on the contrary, is getting worse, the temperature rising and the pulse becoming more rapid and thinner, the only thing to do is to open the abdomen and act according to the conditions found there.

After sterilisation of the anterior abdominal wall, an incision is made in the middle line between the pubes and umbilicus, cutting through the various layers with the utmost caution in case a knuckle of bowel is adherent to the abdominal wall. As soon as the cavity is entered, the bowels are

pushed as high up in the abdomen as possible and the pelvis is walled off by means of large tape-towels wrung out of hot saline or sterile water. The diseased organs are now sought and separated from any of the surrounding parts to which they may have become adherent, care being taken not to rupture any pus sac which may be present. The broad ligament of the affected side is tied off with two or more interlocking ligatures and the diseased organ removed. If pus has escaped into the pelvic cavity it is wiped up as it exudes from the sac and the whole field of operation thoroughly bathed with a hot aqueous solution of formaline, 1 in 500. If the disease was of gonorrhœal origin, it will be quite safe to close the abdomen but when it has been caused by any of the pathogenic organisms a cigarette drain is placed in the most dependent part and the incision closed all around it. When one tube is but slightly affected, it may be opened up, wiped clean and, with its corresponding ovary, left *in situ* with the expectation that it will ultimately become healthy.

When the condition is *chronic*, the symptoms are, naturally, less striking. The patient suffers from a dull ache in the affected side. Again there is a leucorrhœal discharge, which is thick and pustular, but without odour. The menstrual periods are painful, the pain coming on some days before the flow and lasting during the whole period. The flow is excessive and the blood clots. The woman is sterile from the blocking of the tubes, or, when one tube is patent, on account of the accompanying endometritis. Defæcation may be painful, especially when the left appendages are the ones at fault.

On making a vaginal examination, a mass is felt on one or both sides. This mass will be sausage-shaped, the outer end being often the larger part. It may be nodular, either from inclusion of an ovary in the mass or from kinking of the tube itself. There may be no tenderness but usually manipulation of some part of the mass will cause pain. If pus is present, there will be an increased leucocytosis but not so marked as in the acute variety. Dyspareunia is frequently complained of and may be so severe as to prohibit all sexual intercourse.

In *treating* this condition, much may be gained by local applications and douching, using large quantities of warm solution. Instead of boroglyceride, however, it is better to saturate the tampons with a ten per cent. solution of ichthyol in glycerine, as this drug is an antiseptic and also has a mild analgæsic effect. The use of the hot-air bath at times has a wonderful effect in causing the disappearance of these inflammatory masses. The patient receives one treatment

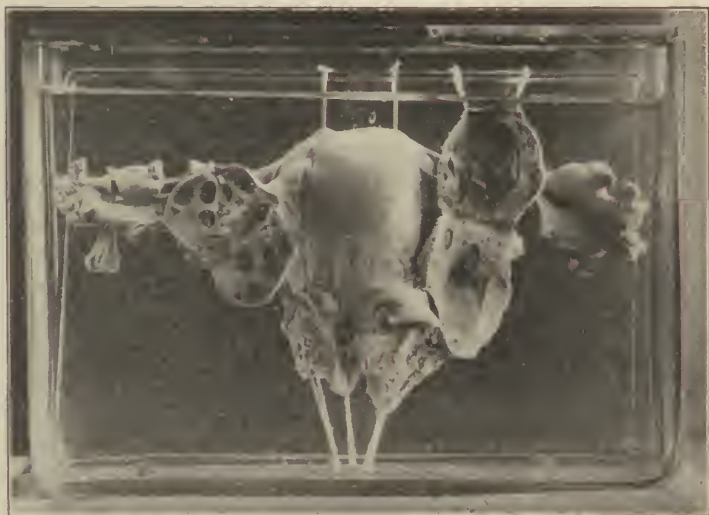


Fig. 3.—Left ovary cystic from chronic ovaritis. Right ovary contains corpus luteum. (Pathological Museum, McGill University.)

daily, each one lasting half an hour, but she must be watched during the first one or two so as to avoid any exhaustion.

When this fails after a thorough trial, the diseased appendages will require removal, either through an incision in the anterior abdominal wall or per vaginam. If both sets of appendages are irreparably diseased, the uterus is almost certain to be badly affected also, in which case many operators advocate making a clean sweep of the pelvis, removing the uterus as well as the appendages, but this is a matter of opinion.

Ovaritis. Inflammation of the ovary without implication of the tube as well is rather rare. Its etiology is somewhat

similar, as are also the symptoms. When one considers the changes which are taking place in this organ, the ripening of the Graafian follicle, its rupture and final reparation, we are surprised that it does not become inflamed more often than it does. It may be acute or chronic.

The *acute* form of this disease is usually caused by extension of germs along the lymphatics from the uterus or vagina or directly from the tube, as where the latter itself is the seat of inflammatory changes. It may also be the result of hæmogenic infection, as where the original focus is in the gums or teeth, and it frequently is a complication of acute parotitis, especially when this occurs in the adult.

It is marked by œdema and swelling of the interstitial portion of the organ, followed, later on, by the formation of small cysts, thus giving rise to the small cystic ovary, which the gynæcologist so vigorously removed in the early days of gynæcology (Fig. 3). It may resolve before the formation of these cysts or may proceed to the developement of an abscess, which varies in size from that of a hazel nut to a large orange. There will be an increased leucocytosis.

The *symptoms* are those of any acute pelvic inflammation, except that the pain from which the patient suffers is more sickening as a rule. Where an acute pelvic infectious process starts up several days post-partum, examination of the pelvis will most often reveal the presence of a rounded, fluctuating mass to one side of the uterus, this mass being an abscess of the ovary.

The *treatment* of acute ovarian inflammation, at all events before abscess formation, will consist in absolute rest in bed and the application of ice over the affected region. A hypodermic of morphine is often required on account of the intense pain and also to quiet the circulation. Even when an abscess is present, it may be overcome by this treatment but it frequently requires evacuation. This may be accomplished by puncture per vaginam when it bulges down into one or other fornix, but this is not unaccompanied by danger, as some of the contents of the abscess may escape into the peritoneal cavity. A better method is to attack the disease through an incision in the anterior abdominal wall, as in the case of the acute salpingitis, and remove the ovary.

Chronic ovaritis usually results from the acute but may be seen in women who have never given any symptoms of the latter, resulting from any cause of chronic or rapidly repeated congestion of the organ, as chronic constipation, sedentary habits, too frequent sexual intercourse, etc.

The subject of this trouble will have a dull, aching pain in the affected side, aggravated on walking. She will also most likely complain of dyspareunia, the pain starting after full insertion of the male organ. If the left side is affected, there will be painful defæcation.

Local examination will reveal the presence of an enlarged, tender ovary which is usually below the normal level. It may or may not be mobile, depending largely upon as to whether or not it has followed an acute attack, in which case adhesions would probably be set up between it and the side of the pelvis or uterus, towards which it tends to sag.

In *treating* this condition, the local use of iodine, tampons and hot douches will often be remarkably beneficial, and their effect will be enhanced by the employment of the hot air bath. This treatment ought to be persevered in for several weeks before giving up hopes of a cure. In the event of failure, removal of the offending ovary will be necessary.

EXTRA-UTERINE GESTATION.

When the Graafian follicle becomes ripe, it bursts, allowing the ovum to escape into the peritoneal cavity, there to wander around and become absorbed or to enter the Fallopian tube by its fimbriated extremity. It may proceed onwards into the uterine cavity or even into the vagina, there becoming lost. If, however, it encounters the male element in any part of its course, it becomes fertilised and proceeds to develop. Normally it becomes attached to the mucous lining of the uterus, where it attaches itself and proceeds to develop. When, on the other hand, fertilisation and implantation take place before the uterine cavity is reached, the condition is known as "extra-uterine" or "ectopic gestation."

Anatomically, extra-uterine gestation is classified as ovarian, abdominal or tubal, the latter being again subdivided into ampullary, isthmian or interstitial, according as to

whether the ovum develops at the fimbriated extremity ("ampullary"), or isthmian part of the tube or in that part of the tube which is embedded in the actual wall of the uterus. All varieties are due to some congenital abnormality or previous diseased condition of the tube. The Fallopian tube is normally lined with epithelium, the cilia of which have a wavy motion towards the uterus which speeds the ovum onwards and prevents the migrating spermatozoa from ascending to the cavity of the tube or peritoneum. When the cilia are destroyed by inflammation or the pressure of a tumour, this inhibitory action ceases and the spermatozoa are free to enter and travel along the tube.

In certain conditions, the spermatozoa encounter and fertilise the ovum just as it is about to escape from the ovary, in which case the "ovarian" form is developed, or the ovum may have entered the tube before it meets and joins forces with its partner, in this instance becoming attached to and finally embedded in the mucosa lining the tube. The "abdominal" variety is usually secondary to one of the others, as where the ovum develops in either the tube or ovary and then escapes into the abdominal cavity, where it attaches itself to the peritoneum and there proceeds to grow.

Classified according to the symptoms present, this condition is spoken of as "a leaker," characterised by repeated attacks of faintness without loss of consciousness, or of the "fulminating" type, where the sac has actually ruptured, producing all of the symptoms of serious intra-peritoneal hæmorrhage with collapse.

The *etiological factors* are either congenital or secondary. Occasionally the tube has one or more secondary openings at the fimbriated extremity or its wall contains sacs, either of congenital origin or due to folds caused by inflammatory action of the peritoneum covering the tube.

Age has but little influence on this condition but, naturally, it is most frequently met with during the period of the woman's greatest sexual activity, *viz.*: between the ages of twenty-five and thirty-five.

Symptoms. The belief formerly held that this condition was always preceded by a long period of sterility has been

disproved, as case after case of tubal gestation immediately following a full term delivery is noted.

1. In one variety of case, the woman will have missed one or two periods, and will complain of a dull aching pain in one side. Then there will be slight staining of the underclothes daily for several days.

2. In another case, the last period may have been normal in every respect. The next period begins but, instead of



Fig. 4.—Tubal gestation with rupture near uterine end.
(Private collection.)

becoming fully established and lasting the usual number of days, a slight discharge of blood takes place daily, this blood-loss often being described as a “dribbling” by the patient.

In either of these cases, the woman may have recurrent attacks of sharp pelvic pain, followed by faintness, and slight increase in pulse-rate but there will be little change in the temperature. A pelvic examination will reveal an ovoid mass to one side of the uterus, but separated from it. This mass is firm, but not tense, and slightly sensitive. Repeated examinations show a steady increase in its size. The pain steadily becomes more severe (Fig. 4).

3. Finally, one or possibly two periods have been missed and the patient considers herself to be pregnant, when, usually between the eighth and tenth weeks, she is suddenly seized by a sharp, agonising pain in the affected side and the woman falls in a faint. While usually felt over the seat of rupture, the pain may be referred to some distant part of the body, as the region of the liver or gall-bladder. The mucous membranes are blanched, the skin becomes waxy in appearance and the respirations are of a sighing character, significant of "air-hunger." The pulse is extremely rapid, running up to 120 or 180 beats per minute, and the temperature is sub-normal, falling possibly to 95 or 96 degrees Fahrenheit. Examination of the abdomen may, or may not, reveal the presence of fluid in the flanks, or it may be that the tympany in that region is simply impaired. There will be tenderness and, at times, a sense of resistance over the affected side. In many cases of ectopic gestation, a more or less complete cast of the uterus is thrown off, thus giving the impression that the woman is having an ordinary miscarriage. On vaginal examination, the uterus is found to be pushed to one side with a fullness in one or both lateral fornices. If examined several hours after rupture, a boggy mass is felt in the pelvis, due to clotted and semi-organised blood. Occasionally but little can be made out per vaginam more than a sense of resistance, this being due to the out-poured blood masking the distended tube or ovary. If seen several hours later, or in case of repeated attacks of pain and faintness, the patient may complain of irritation of the bladder or bowel, feeling a constant desire to micturate or go to stool, or possibly either organ may be obstructed, this symptom being due to pressure of the escaped blood upon the viscus.

The cases in which there are repeated attacks of pain and faintness are those in which the ovum has been implanted near the fimbriated extremity of the tube. Its growth causes stretching of the tubal walls, which results in the tearing of the small blood-vessels. A small amount of blood escapes into the peritoneal cavity where it sets up a localised peritonitis. The clots become organised and form part of the wall of the sac. This is the "leaker" variety of ectopic gesta-

tion, while the "fulminating" type is simply that in which actual rupture of the tube has occurred (Fig. 5).

Differential Diagnosis. At times it is very difficult to distinguish between ectopic gestation and other conditions, such as appendicitis, pelvic tumour with a twisted pedicle, and ordinary threatened uterine abortion, but when the patient is seen immediately after rupture of the sac, there should be little difficulty in arriving at a correct conclusion.

1. In *appendicitis*, there is no history of amenorrhœa, nor

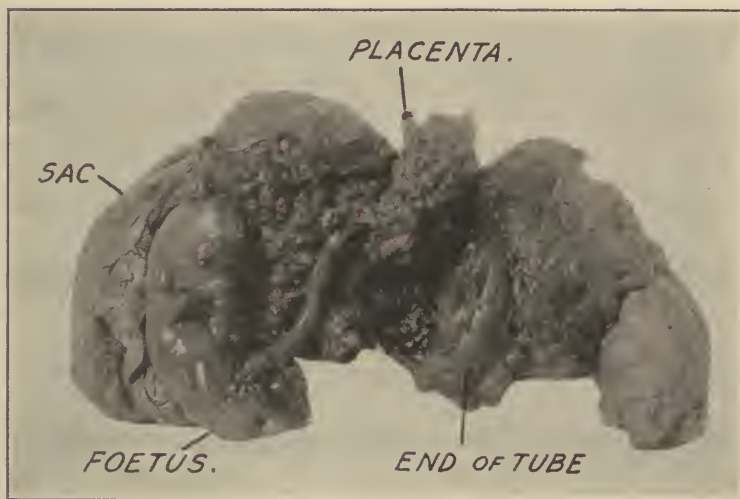


Fig. 5.—Tubal abortion. Secondary rupture at fifth month.
(Private collection.)

is the shock of a ruptured viscus present. There is no dribbling of blood from the uterus. Microscopic examination of the blood will present a higher leucocyte count than in ectopic gestation. There is more vomiting and you will usually obtain a history of rather marked constipation. Palpation of the abdomen will elicit the fact that the point of maximum tenderness is over McBurney's region. There will be splinting of the abdominal muscles over the appendix and re-bound pain will be present. The temperature will be elevated, not depressed. Per vaginam, no mass may be felt or, if one is present, it will be found to be high up in the pelvis.

2. If the cause of the illness is salpingitis, you will usually obtain a history of gonorrhœa or of sepsis following pregnancy, or there will be tuberculous disease in some other part of the body. The leucocyte count is high, especially in the acute form of salpingitis. The temperature is elevated and the pulse-rate increased but not to such an extent as in extra-uterine gestation, nor are the mucous membranes so blanched in salpingitis. There is no history of amenorrhœa, nor is there any dribbling of blood from the genitals. The illness is probably one of long standing, unless in the acute form.

3. Where the patient has a pelvic tumour with a twisted pedicle, the onset is usually sudden and is accompanied by shock but not so marked as in tubal rupture. At times, the twisting will take place gradually but in such a case there ought to be doubt as to the condition. The presence of a definite mass in the pelvis may be made out and the lower abdomen will be distended. Often one will obtain a statement that there has been a pre-existing enlargement of the abdomen, or the patient will say that she has always had a "high stomach," especially if she is young.

4. A patient the subject of a threatened abortion gives a history of amenorrhœa and she will have intermittent, cramp-like pains in the pelvis. There will be a discharge of blood from the uterus. The cervix is soft and the external os patulous with possibly portions of the ovum protruding from it. The uterus is enlarged proportionately to the period of gestation. There will be no tenderness, either abdominal or pelvic, or if any is present it will be slight. It must be remembered that any two of these conditions may co-exist and one must not exclude a ruptured tubal pregnancy simply because the woman has a high temperature and gonorrhœal discharge.

Treatment. Once ectopic gestation is diagnosed, the only thing to do, when the circumstances permit, is to remove the offending organ and the route of choice should be through the anterior abdominal wall, as one wants to act quickly and to be able to see the exact condition of affairs as the operation proceeds. If the woman is in bad condition, the operation should be preceded, or accompanied, by the administration of normal saline solution either per rectum or by the

sub-mammary method, in order to help take the place of the blood lost. As soon as the abdomen is opened, search for the affected organ and cut off all blood supply from it by passing one pair of long forceps over the tube and round ligament and under the ruptured point and a second pair from the outer side in such a manner that it may meet the first pair. Then cut across the broad ligament between the forceps and tubal sac and close over the ligament by a continuous catgut suture from side to side. Release the forceps and see that there are no bleeding points exposed, after which all blood should be removed from the abdomen, if the condition of the patient warrants a prolongation of the operation, as the presence of blood-clot in the abdomen favours the formation of adhesions. Finally, fill the abdominal cavity with saline solution and close the incision. Where the patient is in a serious condition, one has to work quickly so as to get control of the bleeding and to get her back to the ward as soon as possible, so that the ovary may be included in the parts removed, but when time permits and the ovary is healthy, it ought to be isolated from the tube and not removed. Some operators split the affected tube, turn out its contents and suture its mucosa to the peritoneal covering in hopes that it may be restored to use, but the chances of its doing so are so doubtful that it is better to remove it at once. Other gynæcologists remove the appendages on the opposite side as well, so as to prevent the possibility of there being any recurrence of this accident but this is not good practice. Not more than five per cent. of women have a second ectopic gestation and many subsequently bear healthy children, one of the writer's patients giving birth to three full term children normally within three years after the appendages of one side had been removed for this condition.

If, for any reason, it is not possible to operate at once, place the patient in bed, the lower end of which should be raised. Apply ice to the abdomen and keep her lightly covered. Administer saline solution per rectum, under the breasts or intravenously. Of these methods, the rectal will usually suffice, introducing from four to six ounces gently into the bowel, as more would probably be rejected. If the condition is not urgent, the use of the Murphy drip is to be

recommended as it ensures a steady supply of solution to the system and may be kept up for several hours. If the pulse is extremely rapid and feeble, the solution is better introduced beneath the breasts but its introduction directly into a vein is rarely called for. Where the absorption of the fluid from under the breasts is slow, it may be hastened by the application of heat over the distended mamma and by massage of that organ. It is well to give a dose of morphine hypodermically to quiet the action of the heart so as to lessen the blood-pressure at the point of rupture. It may be necessary to administer a stimulant to the heart, so as to tide the woman over the critical period until the saline is absorbed, but it should be given sparingly. The saline itself serves as a stimulant and also takes the place of the blood lost, whereas other stimulants simply increase the cardiac activity and so favour the continuance of the bleeding. The heart requires as much fluid as possible to work on, so the blood may be forced into the upper part of the body by firmly bandaging the legs from the toes up, and it may be well, occasionally, to bandage the arms in addition. If the woman is very thin, a pad may be placed over the abdominal aorta and pressure be applied by a tight bandage but this is of doubtful value.

The treatment of a case of ectopic pregnancy where the ovum has gone on to full term deserves special consideration. It is a debated question as to whether the fœtus should be allowed to die before its removal or this should be attempted during the life of the ovum. In the case of ordinary uterine pregnancy, there is no doubt as to the course to be pursued as here one has a contractile muscular organ with which to deal after removal of its contents. In ectopic pregnancy, it is entirely different as the wall of the sac contains no muscular elements, so that the removal of the placenta is followed by a severe hæmorrhage which nature can do little to check. For that reason, the older operators would allow the fœtus to perish before opening the sac, as then the placental circulation would have ceased to exist and the vessels would be thrombosed, allowing the placenta and membranes to be stripped off without fear of uncontrollable bleeding. In these days of aseptic surgery, however, it is deemed best

to open the sac during the life of the foetus, and remove the child after tying off the cord. The edges of the sac are sutured to the edges of the abdominal incision and the cavity packed with sterile gauze. This is changed daily and the foetal structures will eventually come away without causing any trouble. The sac will then close rapidly.

Prognosis. A large proportion of unoperated cases die as a result of rupture of the sac, but if seen early and bleeding is stopped by operative interference before the loss of too much blood, the prognosis is excellent. In fact there is no class of case which gives more satisfaction to the operator than an ectopic when seen in time as the operation is almost devoid of risk whereas the condition is usually fatal if there is not prompt interference. To secure the highest rate of recovery, operation must be resorted to at once, no matter how serious is the condition of the patient. He who waits until the woman has recovered from the shock of the rupture before opening the abdomen will lose many more cases than the man who goes in at once, irrespective of how serious condition the patient may be in at the time. It is the blood-loss which kills and it must be controlled at the earliest possible moment.

Terminations. When the ovum is situated in the tube, the latter usually ruptures between the eighth and twelfth weeks of gestation. This rupture may occur into the peritoneal cavity or between the layers of the broad ligament. The latter situation is the least common but gives the best prognosis, as the space is limited so that the escaped blood exerts so much pressure upon the ovum that it perishes, in which case there is every chance of its being absorbed. If the ovum has been arrested in the interstitial portion of the tube, it frequently becomes extruded into the uterine cavity and there develops to full term and no one is the wiser that it has started as a pathological pregnancy. When the pregnancy is of the ampullary variety, the ovum is often expelled, in whole or in part, into the peritoneal cavity and there develops, obtaining its nourishment from the peritoneum or else from a partial attachment to the tube. Upon the death of the ovum, the foetus may become mummified and remain perfectly quiescent in the pelvic cavity. In some cases, the

sac becomes infected, with the result that an abscess forms and ruptures into the peritoneal cavity or one of the adjacent viscera, such as the bladder, vagina or rectum, or even through the anterior abdominal wall, the remains of the ovum being discharged through this opening. Occasionally, the ovum becomes impregnated with lime salts, forming a "lithopædion" which may lie in the pelvis for many years without giving trouble. The writer once removed such a specimen, the ovum having been killed eighteen years previously by the application of electric currents to the pelvis.

MALIGNANT DISEASE.

CANCER OF THE VAGINA.

Primary cancer of the vagina is supposed to be very rare but it is probably more common than imagined because the early symptoms are so slight that the disease is far advanced before discovery, when it may have spread to the cervix (Labusquiere). In many cases, it is only by examining the whole uterus and vagina after removal that the primary site can be determined. From 1500 to 2000 females are admitted yearly to the public wards of the Montreal General Hospital and yet only three cases of primary cancer of the vagina have been recorded among the admissions, *viz.*: one by Dr. H. M. Little and two by the writer. According to the statistics of Himmelfarb the vagina is the primary seat in between two and three per cent. of cases of cancer of the female genitalia, while Williams only gives it credit for 0.43 per cent. When present, it usually affects the upper third of the posterior wall. The histological type is the epithelial and it may be diffuse and infiltrating or circumscribed. In the latter case, it appears as a cauliflower growth projecting into the vaginal canal and being attached to the wall by a broad pedicle. It tends to spread superficially at first but later on it burrows deeply into the tissues (Fig. 6). It bleeds readily on contact.

Just as elsewhere in the body, vaginal cancer is caused by irritation, which, in this case may be set up by wearing a pessary or irritating uterine discharges.

Symptoms. First there is an increase in any leucorrhœal discharge which may have been present or the appearance of such a discharge when there was none previously. This soon becomes stained with blood and, a little later, comes to



Fig. 6.—Primary cancer of the vagina. (Montreal General Hospital Museum.)

possess a foul odour. The patient may complain of pain which radiates into the groins and down the thighs. When the disease has been present for some time, the patient presents the usual cachectic appearance which accompanies

malignant trouble. There will also be loss of weight and general ill-health.

Treatment. As early extension occurs, on account of the very free vascular and lymphatic supply of the parts, complete removal of the uterus and greater part of the vagina is indicated, taking great care to cut well free of the disease. If the patient comes under observation at a very early stage, it will be sufficient to excise that part of the vaginal wall bearing the growth, removing a wide collar of healthy tissue as well. After operation, the patient should be submitted to the X-rays or else radium may be substituted, and is probably the best.

The **prognosis** is bad on account of the tendency for the cancer to spread beneath the surface.

CANCER OF UTERUS.

Cervix.

Cancer may start either on the vaginal covering of the cervix or actually inside of the canal. In seventy-five per cent. of cases of uterine cancer, the cervix is the part primarily affected, the remaining twenty-five per cent. being met with in the body.

Etiology. Heredity plays an unimportant part in cancer of the uterus, merely furnishing a tendency towards its occurrence. While no case of transference to the physician or nurse has yet been reported, instances are frequently seen where transplantation by actual contact has taken place in the same person. Irritation undoubtedly plays a most important part in the development of cervical cancer. Frankl claims that only three per cent. of cases arise in women who have never born children, and a certain proportion of these probably occur where the cervix has been forcibly dilated with a consequent development of scar tissue. When the fundus is affected, pregnancy has little effect in its development, a very small percentage occurring in parous women. It is most difficult to account for this form, unless it is due to irritation set up by the presence of a fibroid in the uterine wall, but many cases are seen where no such condition exists.

Cancer of the cervix is most apt to start between the ages of thirty and forty but may be seen much earlier or later.

Its rate of growth is much more rapid in the younger women and those who become pregnant, this being accounted for of course by the pelvic blood-supply being richer in these two conditions.

Pathology. The portio vaginalis cervicis is covered with squamous epithelium, consequently, when it is affected by cancer, it is the epithelial or squamous type which is seen. The canal, however, is lined by cuboidal cells, so that here you may have either the epithelial or glandular type, the latter being called "adenocarcinoma." Fortunately the differential diagnosis between the two types is unimportant, as it rarely can be made without the aid of the microscope.

When arising from the epithelium covering the cervix, it usually spreads to the wall of the vagina by direct extension, while when it begins in the actual cervical canal it penetrates the wall and so extends into the paracervical tissue. Either variety, however, may spread upwards or downwards as the case may be.

Diffusion takes place either by direct extension or by the cells penetrating the blood or lymph vessels. When the latter are invaded the cells are carried to the hypogastric or iliac glands or even to those of the groin. As advance takes place, the adjacent structures become infiltrated, the bladder and rectum being attacked, causing recto-vaginal or vesico-vaginal fistulæ. In long standing cases, openings between the bladder, vagina and rectum form, a regular cloaca resulting. Now and then the ureters are surrounded by the growth, obstructing the outflow from the kidneys, with a consequent hydro-nephrosis. On account of extension taking place through the lymphatics, metastases in distant parts of the body are liable to form. The nerves are only affected late as a rule in cancer of the cervix, and this fact cannot be too well borne in mind, as there will be little or no pain until they are implicated.

There are three clinical types of this disease: (1) Vegetative type, where the disease begins in the vaginal mucosa, producing the cauliflower form; (2) Infiltrating, which starts inside of the cervix and extending outwards to the parametrium, causing hardening and fixation of the tissues, and

(3) Ulcerating form, characterised by the breaking down of the tissues involved (Fig. 7).

Symptoms. The symptomatology of all three varieties is similar. The earliest manifestation of something being wrong is vaginal hæmorrhage. It shows itself as a slight bleeding, following any cause of pelvic congestion, such as coitus or defæcation. Following either, the woman notices a small amount of blood at the orifice of the vagina. This loss increases as time goes on until finally it is very serious. The blood appears suddenly, is bright red in colour and ceases as suddenly as it began. Or the woman will first be conscious of the presence of a leucorrhœal discharge, which sooner or later assumes a blood-stained appearance. The hæmorrhage is due to the erosion into a vessel and continues until the artery or vein is eaten across, when the inner coats contract and so plug the vessel. At first, the discharge has no odour, but soon becomes tainted and, later on, is extremely foul smelling. By the time the odour becomes marked, the skin will be seen to be of a dirty yellow tinge due to absorption of the toxic products of the disintegrated tissues. Pain will now occur and is usually felt in the lower part of the back and running down the legs and is worse during the night. At first this is a dull ache but in the later stages frequently becomes extremely acute. It must be remembered that *pain is a late symptom in cancer of the uterus* as a rule, so that one should not fail to suspect the presence of cancer simply because the woman has no pain. Ignorance of this fact is the needless cause of the death of many a woman who might certainly have been saved, if she had been carefully examined before the disease had become too extensive.

When the bladder wall is infiltrated, the patient complains of frequent, and at times painful, micturition, and of course when so eroded as to produce an opening into the bladder the urine constantly escapes. A similar result is seen when the rectum has been opened up by the disease, the bowel contents then being discharged through the vagina.

As a rule, the woman becomes extremely emaciated, although occasionally she may retain her usual size, but this is rare.

Local Examination. If there is the least suspicion of cancerous disease, a local examination of the pelvic contents must be insisted on. It is better to lose the patient than run the risk of overlooking the possibility of the presence of this most dread malady.



Fig. 7.—Cancer of cervix. Note erosion of inner surface only.
(Private collection.)

In the early stage of affection of the vaginal portion of the cervix, the examining finger will detect either a small, hard nodule on the cervix or a heaping up of the vaginal epithelium at some one spot, and the finger will be blood-stained, especially in the latter variety. On exposure of the

cervix by means of a speculum, the diseased areas will be seen to be red and inflamed in appearance. Nothing more may be seen or felt but the physician should be suspicious and should take a section right through the suspected area from vaginal mucosa to the actual cervical canal. This section ought to be submitted to an expert pathologist for his opinion. Where the interior of the cervix is the original site, little or nothing may be seen but the cervix is felt to be harder, and probably a little larger, than normal. Later, a warty outgrowth will be seen or felt or an apparent ulcer will be observed, this ulcer bleeding freely on irritation by the examining finger. When further advanced, there will be either a large cauliflower growth springing from the cervix or the latter will have become so broken down and destroyed that it will present a distinct cavity, as if a cone of cervical tissue had been removed. On palpation, the margins of this cavity will be felt to be very hard and the surface rough. Inspection will show the surface to be covered with patches of greyish membrane and some of the previously mentioned foul discharge. Even the lightest scraping of this surface will cause pieces of tissue to come away. The inguinal glands may now be felt to be enlarged and hard. The fundus is little affected but the whole uterus may be fixed in the pelvis. This fixity is usually due to extension of the disease through the cervix and paracervical tissue to the lateral wall of the pelvis but may possibly be caused by a previous attack of pelvic inflammation setting up adhesions. A history of such an attack should be sought, as fixation from extension of the cancer will absolutely preclude any radical treatment, while if it is due to inflammation it may be possible to remove the whole diseased uterus.

If a section be examined microscopically, numerous patches of necrotic tissue and hæmorrhagic areas are seen. The blood-vessels are numerous and their walls may be normal or composed either of numerous layers of epithelial cells or a single layer of endothelium. In places they are filled with epithelial cells. These cells are also seen to have invaded the deeper tissues and to have replaced them to a large extent, while fine fibrous trabeculæ run in various directions through the section. Numerous cell-nests are scattered

through the field of vision, making the diagnosis of squamous celled carcinoma both easy and certain.

Treatment. In deciding upon the method of treatment to be adopted, the first question is, can the patient be cured by treatment or only relieved? Not over thirty per cent. of all the cases seen yield a good prospect of cure, no matter what line of treatment is adopted, and many of these prove to be disappointing when removal is attempted. "European operators give an average operability of sixty-five per cent.; American figures show only thirty-five per cent. of carcinomas in an operable condition" (Anspach). Even the American percentage is generous.

In cases of cancer of the cervix which are not submitted to operation, death results in from one to two years from the onset of the disease and the end comes more rapidly in young women and where the cancer is of loose structure and very vascular. It is also especially rapid in cases where pregnancy supervenes, due to the increased vascularity.

Where the disease has spread beyond the cervix, the prognosis is almost hopeless, as, even where the uterus is removed, recurrence is almost sure to take place within a few months, although radium may lessen or retard the reappearance of the disease.

When the uterus is freely moveable and the cancer is confined to the cervix, removal of the whole uterus, together with a broad collar of vagina and as much of the surrounding cellular tissue as possible, is the only method to employ. On account of the necessity of making as clean a sweep of the pelvic contents as possible, the abdominal route is preferable to the vaginal, even although convalescence is more rapid and uneventful when the uterus is removed per vaginam.

Where there has been much destruction of the cervical tissue, as much as possible should be removed by the cautery before attempting the more radical treatment. Then, with the patient in the Trendelenberg position, a good free incision is made in the middle line, between the umbilicus and pubes. The intestines are pushed up into the abdomen and retained there by tape gauzes. The uterus is drawn up as far as possible into view. Two ligatures are passed around the upper part of the broad ligament and the tissues divided

between them, the appendages being left when healthy and there is no chance of disease having encroached upon the uterine cavity. If it is invaded, the ovary and tube are to be removed also, one ligature, in that case, being passed around the outer border of the broad ligament, which is divided between the ovary and the outer ligature. The broad ligament of the opposite side is treated in a similar manner. The fundus is then held away from the pubes and the attachment of the bladder to the uterus defined. This is indicated by a fine white line, running across the uterus. An incision is made through the peritoneum along this line and the bladder separated from the fundus, working with the finger or handle of the scalpel as much as possible. Each uterine artery is sought for and a ligature passed around it, as near the lateral wall of the pelvis as possible, and tied. There is little danger of harming the ureter, if, in dissecting the bladder off the uterus, care be taken to separate the tissues well downwards and outwards from the middle line. After both arteries are tied, they are divided in turn between the ligature and cervix. The uterus is now brought forwards so that the posterior vaginal wall is put on the stretch and a flap of peritoneum is dissected down from it. It is well to commence the flap just below the cervix in case the disease has penetrated deeper than it appeared to have gone. The uterus is then drawn well up and the upper part of the vagina is dissected from the surrounding tissues to a lower level than it is intended to be divided. A pair of right-angled forceps is passed across the vagina from each side, so as to completely close it, after which the walls are cut across below the clamps, thus enabling the operator to remove the uterus with its cervix enclosed in a collar of vagina. One should now feel most carefully for any enlarged glands, which ought to be removed, if found. The anterior and posterior vaginal flaps are to be united by a continuous suture, drawing the stump of each broad ligament down and uniting it to the vagina, after which the vaginal and vesical flaps of peritoneum are attached to each other over the whole field of operation by a continuous suture. After making sure that there are no leaking vessels, wipe the pelvic cavity dry, remove the gauzes and close the abdominal incision, using

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one continuous suture for the peritoneum, a similar one for the fascia and a third for the subcutaneous tissue. The skin edges are now to be approximated by a subcuticular suture of silkworm-gut. This is inserted by perforating the skin just below the lower end of the incision, and taking up a small amount of tissue on each side of the wound alternately, going fairly deeply into the tissues but taking care not to enter the actual cuticle, as this is apt not to be quite sterile.

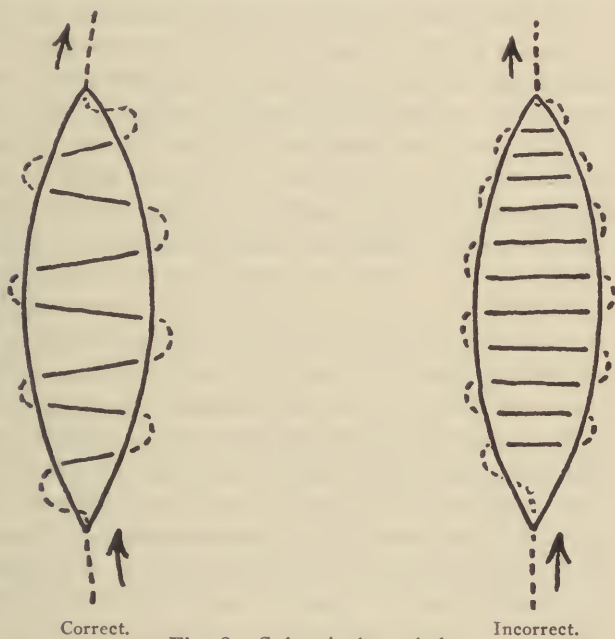


Fig. 8.—Subcuticular stitch.

It is brought out through the skin at the opposite end of the wound. (Fig. 8.) This gives a neat scar and the suture is readily removed if properly inserted and left *in situ* for at least twelve days before attempting its removal. With the exception of this subcuticular stitch, all of the ligature and suture material used is catgut. If one litre of warm saline is left in the abdomen after the operation, the patient will suffer less from post-operative thirst and shock. Just before the patient leaves the operating table, care should be taken to remove all blood-clot from the vagina, either by a douche or with gauzes.

Treatment of Inoperable Cases. When is a case of cervical cancer said to be inoperable? It may be called such when there is little or no chance of a cure following operation. This is where the disease has spread beyond the actual cervix, especially when the bladder or rectum are involved and where the broad ligaments are infiltrated to such an extent as to fix the organ in the pelvis. Practically, however, one is able to perform palliative operations in many such cases. Of these, more is to be hoped for from the use of the cold heat, *a la Percy*, than from any of the others. Percy opens the abdomen and ties off the internal illiac arteries, or, if this is not possible, the uterine vessels. An assistant grasps the fundus and steadies it. The cervix is exposed through a water cooled speculum and the diseased area is thoroughly cooked by the cautery at a black heat, until the fundus becomes too warm for the comfort of the assistant. The abdominal cavity is then closed and the cervical cavity packed with gauze which is saturated by a twenty per cent. solution of iodine with dry gauze protecting the rest of the vagina. This causes the death of all cancerous elements within reach of the heat, which penetrates to a considerable depth. The necrosed tissues separate as a slough and the remaining elements of the cervix contract to such an extent that a subsequent radical operation may be rendered possible. The essential object aimed at by this treatment is a thorough baking with the cautery, not cutting, and if too great heat is employed this aim is defeated, the red hot cautery acting as a knife. Repetition of this cauterisation may be called for at varying intervals, but care must be exerted to avoid injury to the bladder or rectum.

Where it is impossible to use the Percy instrument, a similar, but not nearly so effective, result may be obtained by the use of acetone, applied directly to the diseased surface. Expose the cervix through a cylindrical speculum held firmly in place. Pour pure acetone into the speculum so that the cervix lies in a pool of the drug. After ten minutes lavage, remove the fluid by lowering the outer end of the instrument and allowing it to run out into some receptacle. Wipe the vagina dry and pack it lightly with sterile gauze. These two methods of treatment check the disease and ren-

der the parts moderately free from malodorous discharge and blood, and so tend to lessen the patient's discomfort. While employing the above, daily vaginal douches are advisable and the best deodorant is undoubtedly potassium permanganate in a cherry red coloured solution, but tincture of iodine or any other antiseptic may be substituted. Pain will be alleviated by either heroin or morphin, given *ad lib.*, as the woman's condition is hopeless and it is our duty to render life as comfortable and happy as possible.

The great danger at this stage of the disease is hæmorrhage, which may be so severe as to end the woman's life and which is usually the ultimate cause of her death by draining away her strength. This may be checked by the cautery or else by packing the vagina, which, if done at all, must be done firmly and thoroughly. The packing may be assisted by the administration of calcium lactate, horse serum, or some other coagulant, giving some cardiac sedative at the same time.

Life may occasionally be prolonged and made more endurable by cutting off the uterine blood supply, the patient being enabled to go about her ordinary vocations and remaining free from symptoms for months after tying off the ovarian and uterine arteries. The uterus will obtain sufficient nourishment through the vaginal arteries and their branches. The writer exhibited one such case before the American College of Surgeons in Montreal in 1920. The woman's ovarian and uterine arteries had been ligated twelve months previously. Her uterine discharge and bleeding had ceased six weeks later and when seen by the Fellows she appeared to be in perfect health and had been doing all of her own housework for several months.

Curettage, as a preliminary to any of the above, is not to be advocated, as the vessels and lymphatics are opened up, allowing cancer cells to enter and to migrate to distant parts, thus favouring the occurrence of metastases.

Since the discovery of the X-rays and radium, these have been vaunted as cancer cures but have been very disappointing, for the simple reason that they were hailed as sure deliverers from that scourge. We are now getting down to facts and it is generally accepted that they are not infallible

but that they are most useful adjuvants to the knife. There are still some extremists, however, who make most extravagant claims for radium. Two writers, in a recent article, say that "the results of radiation in cancer of the cervix practically removes this class of cases from the surgical field." The general consensus of opinion is well summed up by R. C. Coffee, who says that there "is not yet sufficient evidence to justify the abandonment of surgery for radiation in very early cases." In operable cases, exposure of the diseased part to either radium or the X-rays either before or after complete hysterectomy will be beneficial in warding off any recurrence. A similar course in inoperable cases usually relieves pain and clears up and checks any discharge and undoubtedly tends to improve the general condition of the patient. If it is intended to remove the uterus, it should be done within four weeks of the radiation. Where the radium is applied after removal of the parts, one must be careful on account of the cicatricial tissue which will be present or fistulæ will be apt to follow.

Fundus.

Cancer of the fundus is practically always of the glandular type, but occasional instances of the squamous form are met with, being due to the endometrium having undergone a metaplastic change before the onset of cancerous disease. It occurs later in life than when the cervix is the primary seat, is uninfluenced by previous pregnancies and grows much more slowly.

On cutting open a uterus which is the seat of fundal carcinoma, a fungating mass is seen projecting somewhat down into the cavity, and possibly penetrating into the actual uterine wall. On careful examination, it is seen to be made up of numerous finger-like processes (Fig. 9). If a microscopic examination of these is made, one will observe that there has been a great increase in the size and structure of the glands. The normal cylindrical epithelium may be present but usually there will be a layer of cuboidal cells beneath and the nuclei of both are hypertrophied and usually take on a very deep stain. Each process has a delicate fibrous supporting structure with minute vessels running into it. In some cases, the epithelium will have proliferated to

such an extent as to resemble a squamous cancer. The growth may extend all over the lining of the uterus, or it may perforate the wall into the parametrium of the peritoneal cavity. Metastases usually affect the illiac and lumbar glands but may be seen in any part of the body and, when the disease is of long duration and extensive, the inguinal glands will become affected through the lymphatics of the



Fig. 9.—Cancer of fundus. Note secondary nodule (*S. N.*) to one side of primary. (Private collection.)

round ligament. The *symptoms* are similar to those in cancer of the cervix. There is at first a slight hæmorrhage or leucorrhœal discharge which soon becomes more profuse and malodorous. Eventually the patient exhibits the usual emaciation and cachexia of malignant disease.

On making a local examination, the cervix will often be found to be healthy. The fundus is enlarged and may be either softer than usual or quite hard; you do not get the

“firm” sensation of the healthy uterine wall. In those cases where the cervical canal has become occluded, with the collection of discharges in the cavity, the body will be markedly enlarged and fluctuation will be elicited.

The *treatment* again consists of early and complete removal of the whole uterus, together with both sets of appendages, followed by the use of radium or X-rays, or both.

The *prognosis*, when the case is operable, is good, a large percentage of the patients operated upon making a complete and permanent recovery.

Chorioepithelioma.

Chorioepithelioma is a malignant disease arising from the epithelium of the chorion. In all pregnancies this epithelium proliferates but as soon as the placenta is formed, the activity of these cells ceases. In some cases, however, they continue to multiply and penetrate the uterine tissue. This may be due to their being abnormally strong or to the presence of some substance in the blood which favours their increase. Their growth then becomes irregular and unlimited, forming the malignant growth to which the above name has been applied. It was first described in 1888 by Säger, who thought that it was of decidual origin and so called it “Deciduoma Malignum,” but, later on, Marchand discovered that it arose from the foetal ectoderm and his view has not been disputed.

Etiology. Pregnancy is the great predisposing factor in the causation of this disease, but it is not essential, cases having been observed in young girls before the onset of menstruation, in elderly women and even in men. Those cases in which it does not follow pregnancy are probably due to one of two causes. Either it arises from a teratoma or there has been some inclusion by the developing ovum of trophoblastic cells which have lain quiescent until some mysterious, undetermined agency has caused their active proliferation.

Hydatid degeneration of the chorion has an undoubted influence in predisposing patients to this malady. In 262 cases collected some years ago by the writer, 36.78 per cent. were seen to follow molar pregnancies; 31.80 per cent. fol-

lowed abortions, and 26.43 per cent. occurred after full term labours.

Disease of the ovaries is an important complication and occurs with such frequency as to suggest its having some influence in its production. There is usually an excessive luteal formation, especially in the generation of cysts but it is doubtful if lutealism has any bearing on the question.

Pathology. It may be seen as an irregular, diffuse, fungoid mass deeply implanted in the uterine wall and sending prolongations between the muscular bundles. At other times, it takes the form of a ragged, ulcerating growth with villous prolongations, the uterine wall being entirely eaten through. Occasionally, it may assume a pedunculated form or it may be sessile with numerous nodules lying beneath the mucous surface, the epithelial membrane being practically intact. The tumour varies in size from that of a marble to that of a foetal head. It is usually greyish in colour with dark hæmorrhagic spots, but it may be either dark green or bright red. It is soft and friable, here differing from either epithelioma or fibroids.

Secondary deposits occur both frequently and early, extension taking place by means of the blood-vessels, so that they may be seen in any part of the body but the lungs are the organs which are the first to be attacked, after which come the vagina, liver and nervous system in the above order.

Histology. The typical elements of this tumour are: (1) Small well-defined polyhedral cells with large vesicular nuclei packed together in masses with no connective tissue between them, *i.e.*, cells of Langhans layer. (2) Large multi-nucleated masses of protoplasm (plasmodia or syncytia) in which no definite cell boundaries are visible. (3) Large cells, sometimes mono- sometimes multi-nucleated, some of which resemble decidual cells, others being identical in character with the multi-nucleated giant cells which occur in decidua serotina. These, in some places, are seen to be invading and destroying adjacent tissues as in sarcomata. After entering the vessel, these plasmodia actively proliferate and form a thrombus which may break off and be carried to a distant part, or may remain *in situ*, sending cells into the

circulation to spread the disease. In other cases, these masses become canaliculised and take the place of the original wall of the vessel.

Symptoms. In the typical case, a hæmorrhage which resists all treatment follows the expulsion of an hydatid mole, either soon after or at the expiration of months or years. The administration of drugs fails to effect a cure and even a curettage is of but temporary benefit. Examination of the scrapings may reveal nothing special, as the disease may be very circumscribed and may be missed by the curette. Where, however, there is an early recurrence of the bleeding, especially with a history of an abnormal pregnancy, be suspicious of chorioepithelioma. Local examination will result in the discovery of an enlarged uterus which is rather soft and boggy and which will probably be of equal consistence throughout. It will be freely mobile and the appendages will be healthy. The cervix is soft and the os slightly patulous, but it will rarely admit the examining finger.

No enlarged glands may be felt. When the disease has advanced to any degree, the patient will exhibit the usual signs and symptoms of uterine malignancy, the discharge will have become foul and she will be cachectic and emaciated.

Prognosis. As a rule the patient dies within a very few months, either from exhaustion from the hæmorrhages or the implication of distal and vital organs. In rare instances, spontaneous cure takes place and there are no means available as yet to determine why or in what cases it will occur. Even microscopic examination does not help one. Haultian puts forward the theory that the hæmorrhages which take place into the tissues may, at times, exert such pressure as to cut off the blood supply of the tumour and so cause its death.

The only *treatment* is that of all malignant uterine disease, *viz.*: early and complete removal of the parts implicated with a subsequent exposure to radium or X-rays.

CANCER OF THE TUBES.

This may be either primary or secondary and is a very rare condition. The secondary is much the more common and usually results from spread of the disease from the

uterus. Primary tubal carcinoma may arise from either a papilloma of the tube or degeneration of a cystic or other tubal growth. Pre-existing inflammation favours the formation of cancer in the tube. It may occur in youth but is decidedly more a disease of middle life or old age.

The *symptoms* are those of chronic tubal inflammation with wasting and cachexia. The disease being usually unilateral, the patient complains of a dull pain in one side of the pelvis. When the disease is well established, a thin, blood stained discharge is seen to exude from the uterine cavity.

Local examination reveals in one side of the pelvis an elongated, usually nodular, mass which may be adherent to the pelvic wall, and which is not tender.

A definite diagnosis before removal is extremely difficult, but when a patient, especially of a cancerous age, complains of pelvic pain and a blood-stained serous discharge, and exhibits cachexia and wasting, the presence of a nodular mass to one side of the uterus should lead to the suspicion of cancer and a clean sweep of the whole contents of the pelvis should be attempted.

CANCER OF THE OVARY.

Cancer of the ovary is extremely rare. It may be primary, developing from a Graafian follicle or the germinal epithelium, or it may occur secondarily as a degeneration of an ovarian tumour, either cystic or solid, five per cent. of these exhibiting malignant changes, or by spreading from some of the surrounding structures.

There are two varieties, *viz.*: adenocarcinoma and medullary.

Medullary carcinomata of the ovary form ovoid swellings with a nodular or smooth surface. They vary in size, but are not usually larger than the head of a foetus at full term. They may be intra-ligamentary or have a short pedicle. While the affection may be on one side only, usually both ovaries are diseased.

They have a dense, well marked capsule, and, on section, show a more or less homogeneous picture with a greyish-yellow surface. Occasionally, extravasations of blood into the substance of the tumour give a mottled appearance to the cut surface. Caseous or fatty degeneration commonly

produces cystic cavities with yellowish walls and turbid or yellow contents. Microscopic examination reveals carcinomatous cells with a fine connective tissue stroma, which may form alveoli filled with cancer cells.

Ovarian adenocarcinomata strongly resemble simple serous cysts, being oval or rounded and rarely larger than an adult head. They may have a short pedicle or lie between the layers of the broad ligament, and both ovaries are usually affected. The wall is composed of fibrous tissue which is friable and it is thickened in spots by the development of cancerous tissue. The epithelium lining the cysts may develop papillary outgrowths projecting into, and nearly filling, the cavity. The cyst contents vary in character; they may be clear, turbid or blood-stained from hæmorrhage into the cyst.

It is almost impossible to differentiate between the benign and the malignant adenomatous ovarian growths, as the gradation of one to the other is so gradual. Ziegler finds no clear line of demarcation between the two, while Pfannensteil claims fifty per cent. of ovarian papillomata to be malignant. Metastases are commonly met with in the peritoneum, omentum, liver, stomach, intestine, the opposite ovary and, but rarely, the pleura, in the above order of frequency.

The earliest *symptom* may be the presence of an enlargement on one side of the lower abdomen, but this is usually preceded by pain in the side, dysmenorrhœa, menorrhagœa and vesical disturbance. If the patient is untreated, cachexia and wasting follow and adhesions to surrounding parts form. Ascitic fluid is found free in the peritoneal cavity. The enlargement of these malignant tumours is very rapid.

On making a local examination, an oval or rounded, usually nodular mass is felt to one side of the uterus. It is mobile and may be either cystic or solid.

The only *treatment* is removal of the whole uterus and both sets of appendages.

SARCOMA OF THE VULVA.

When sarcomatous growths attack the vulva, it is usually the labia majora which are affected, but it may develop on

the clitoris (Fig. 10) or any other part of the external genitals. As a rule, it occurs in young women but may be seen in old age. The melanotic is the most common variety but any other form may be observed. All of the species tend to grow rapidly and also to send out metastases, which spread by the lymphatics. It most commonly appears as multiple nodules, but there may be only one. These nodules coalesce and ulcerate. They are hard, dark and rounded and originate



Fig. 10.—Melanotic sarcoma of clitoris.

in either warts or nævi. The round or spindle celled variety is usually single and grows quickly, at times reaching the size of a man's head.

The only treatment is early and complete removal but they are extremely liable to recur, and therefore to be fatal.

SARCOMA OF THE VAGINA.

Sarcomata of the vagina are rare but are most often seen in childhood. When present in adult life, they most often appear at forty years of age or later. They may appear as a polyp or a diffuse infiltration of the vaginal wall, being either confined to one side or extending as a ring all around the

passage which it constricts. While the growth tends to ulcerate, it rarely perforates either the bladder or rectum. Metastases take place relatively early.

The tumour mass is made up of small round, spindle and giant cells but contains no muscular tissue.

The patient complains of a thin, sanæous watery discharge, but no pain. Inspection shows either a polyp with a broad base attached to the vaginal wall or else an area of infiltration, the latter probably forming a ring around the vagina which is thus constricted.

As in the case of sarcomata affecting other regions, the proper treatment is complete removal and even this is of doubtful benefit on account of the early implication of the deeper parts.

SARCOMA OF THE UTERUS.

This is not common at any age but when seen in early youth it is usually located in the cervix as a grape-like mass, which rapidly produces a fatal result. In women of more mature years, the fundus is frequently affected, the disease appearing as a solid growth in one wall or affecting the whole uterine body.

The disease may originate in the fibrous tissue of the uterine wall or in a fibroid tumour which undergoes a degeneration into malignancy. The variety most often observed is the myosarcoma but it may be of the round or spindle celled type. Metastases occur, spreading by the blood stream to the lungs, liver, ovaries and intestinal tract.

The *symptoms* in the adult are similar to those of carcinoma, *vis.*: hæmorrhage, foul discharge, cachexia and wasting. The discharge, however, is more watery and is liable to contain small, hard, white, rice-like bodies.

A diagnosis is almost impossible previous to removal and examination under the microscope, but when a woman has a rapidly growing uterine tumour with watery discharge and emaciation, the probability is that she is the subject of uterine sarcoma.

The only treatment is removal of the whole uterus with the appendages as soon as the condition is diagnosed.

SARCOMA OF THE OVARIES AND TUBES.

Sarcoma of the tubes is so rare as not to require further mention and even ovarian sarcomata are not common, but when it is present both ovaries are affected usually, the varieties being either the round or spindle celled, the former affecting chiefly the younger females. Cohn finds that their relation to ordinary ovarian cystomata is 1 to 100 and out of 400 ovarian tumours of various kinds, 5.38 per cent. were sarcomatous.

Sarcoma of the ovary may grow either very rapidly or slowly and may attain a weight of from twenty-five to thirty pounds. These tumours vary in consistence, those of the spindle-celled variety being hard, while the round-celled are soft and brain-like. They are surrounded by a capsule which may be very soft and friable. The pedicle is usually short and adhesions rarely form; but free ascitic fluid in the abdominal cavity is commonly observed.

On section, the surface is yellowish-white or pinkish-grey, the colour depending upon the number of blood-vessels present, as well as on the structure of the tumour. Small cysts are often seen, due to hæmorrhages into the substance of the tumour with subsequent softening or fatty degeneration of the tumour cells.

The small round-celled growth is the most malignant, the danger of recurrence being much less where there is a large amount of fibrous tissue than where this is scanty. When metastases do occur, they appear in the peritoneum, stomach, omentum, pleura, lungs, uterus, liver, diaphragm and kidneys in the above order. The tumour may undergo degenerations, of which fatty and myxomatous are the most common.

The *symptoms* are few at first, but ascites develops early and will help to differentiate sarcomata from the more benign growths. Pain and menstrual disturbances are also more common than in myomata. The physical examination yields similar results in sarcoma as in benign ovarian growths.

The *treatment* is early removal, and the post-operative prognosis as regards recurrence is good in the hard, spindle-celled variety but not so favourable when the growth is soft and round celled. A unilateral growth gives a more favourable prognosis than when both ovaries are diseased.

UTERINE FIBROIDS.

There is a form of non-malignant tumours of the uterus which are termed "fibroids," "fibro-myomata" or "leiomyomata." They may be classified as "fundal" where they are situated in the fundus or body of the uterus, or "cervical" where the cervix is the seat of the disease (Fig. 11). Another division is into "intra-mural," "sub-mucous" and "sub-serous." Most



Fig. 11.—Large cervical fibroid polyp.

of these start in the centre of the wall of the uterus. If they grow equally in all directions so as to have a similar amount of muscular uterine wall all around them, they are said to be "intra-mural" or "inter-stitial." When separated from the cavity of the uterus by the mucous lining only, or possibly by a thin layer of muscular tissue in addition, they are called "sub-mucous." If they project from the uterine wall towards the peritoneal cavity and are only covered by peritoneum, the term "sub-serous" or "sub-peritoneal" is applied to them. When they project from the uterine wall towards the peritoneal cavity, or that of the uterus, having a broad attachment to the uterine wall, they are said to be

“sessile,” while if they are connected to the uterus by a distinct stalk they are known as “pedunculated fibroids.” A uterine polyp is nothing more nor less than a pedunculated mass, consisting of mucous membrane or fibroid tissue, projecting down into the cavity of the uterus.

Fibroid tumours of the uterus are extremely common, at



Fig. 12.—Multiple fibroids of fundus (sub-peritoneal).
(Private collection.)

least sixty per cent. of women possessing them, although comparatively few give rise to any symptoms. They are most commonly met with in women between thirty and forty years of age. The uterus may contain but a single nodule or there may be a very large number, which vary in size from that of a hemp seed to a mass weighing thirty or forty pounds (Fig. 12). As a rule the growth is slow but at times they take on more rapid increase in size, in which case malig-

nancy must be suspected, soft, myomatous tumours found in young subjects being especially prone to a rapidity of growth.

These tumours have a distinct capsule enclosing masses of fibrous tissue, arranged in whorls, with bundles of muscular tissue intervening. As a rule a few very small blood-vessels are seen, the tumour being nourished chiefly through lymphatics which run between the fibrous bundles, and there are no nerves in the actual tumour. Occasionally, the capsule is not well defined in some one portion and when that is the case the tumour ought to be carefully examined for some form of malignancy. The true fibroid is extremely hard but when it contains much muscular tissue it may be quite soft in consistency, the density of the growth varying with the relative amount of fibrous and muscular elements present.

Symptoms. The symptoms depend largely upon the position of the tumour in relation to the cavity of the uterus. However, irrespective of the location of the tumour, any fibroid which is large enough may produce symptoms of pressure or weight upon some of the neighboring structures, this depending chiefly upon the size of the tumour. The increased size, and therefore weight, of the uterus will produce pain in the back or dragging pain in the sides of the pelvis. Pressure on the bladder causes irritation of that viscus, usually relieved by the patient assuming the horizontal position, or the pressure may be upon the urethra, causing complete obstruction to the outflow of the urine from the bladder. At times a temporary albuminuria is caused by the pressure of the tumour upon the ureter. Encroachment of the tumour upon the rectum is liable to cause irritation of the bowel or complete obstruction, the tumour acting as a ball-valve. The pelvic nerves may be subject to pressure, causing pain radiating out to the sides of the pelvis or down one or both legs, this at times simulating typical sciatica. When the growth is sufficiently large, the intestines and stomach are so interfered with as to affect the woman's nourishment, in which case there may be great emaciation, or it may even encroach upon the diaphragm so as to impede the action of the heart and lungs.

Apart from the effects of pressure, interference with menstruation is the chief symptom and this depends entirely upon the relation of the tumour to the endometrium. A tumour which is situated subperitoneally has absolutely no effect upon the menstrual function. When it is located in the substance of the uterine wall, *i.e.*, when it is an interstitial growth, the menstrual flow is slightly increased in

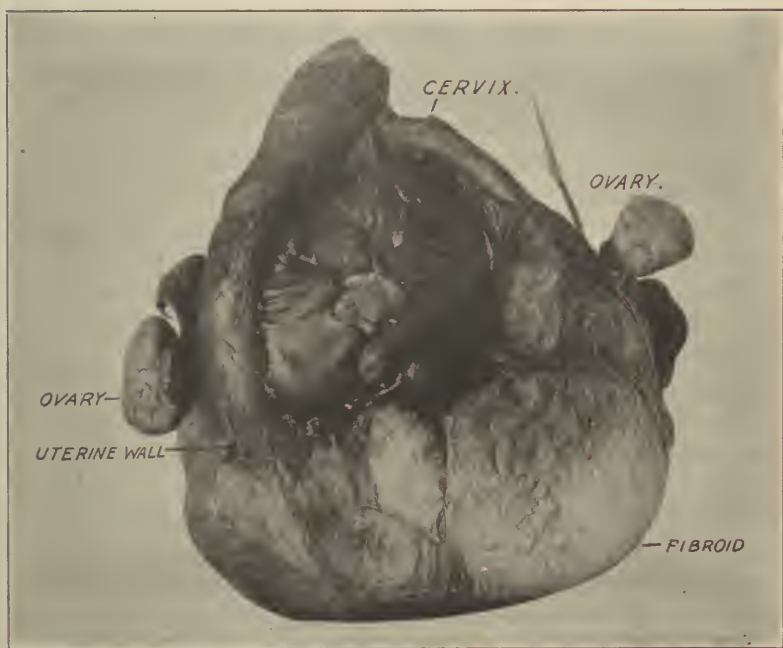


Fig. 13.—Multiple fibroids with pregnancy. (Shows fibrous structure of growth.) (Private collection.)

quantity, but if a sub-mucous tumour is present there is always an abnormally profuse flow and there may even be an inter-menstrual discharge of blood from the uterus. In other words, there is always menorrhagœa and there may be metrorrhagœa. This menorrhagœa may be simply an exaggeration of the normal amount of menstruation or actual flooding may take place, the blood tending to clot, in either case. In most cases, the patient complains of intense pain, which begins some days before the expected period and lasts

until the flow has terminated. She also has a leucorrhœal discharge.

While the sub-peritoneal variety has no effect upon the fecundity of the patient, conception is unfavourably affected in the other forms of fibroid disease, probably by the unhealthy condition of the endometrium; and, where conception does occur, the pregnancy is liable to be terminated prematurely (Fig. 13). In those cases where the woman goes to full term, post-partum hæmorrhage is to be expected and guarded against. In some cases, Cæsarean section will be required, especially where the tumour is low down in the uterus or in the actual cervix, but, unless the growth is locked in the pelvis, it is usually possible to push it up out of the way of the descending fœtus. While pregnancy favours rapid enlargement of the tumour, the subsequent involution equally favours a rapid diminution in the size of the growth and numerous cases are on record where this has not stopped at the original size of the tumour but has gone on until no mass could be discovered on examination, but this happy result is, unfortunately, very rare.

Various circulatory disturbances are very frequently met with in cases of fibroids of the uterus. The commonest is anæmia. This may be due to actual loss of blood, to interference with alimentation or to toxic absorption from the tumour itself, although the importance of this has only recently been brought out. There may even be heart murmurs with irregularity and rapidity of pulse. These, however, usually disappear after the removal of the tumour and are not to be taken too seriously when considering the question of operation.

Signs. The local findings will depend upon the location and number of nodules. Where the symptoms are caused by a cervical polyp, this is usually felt and seen to protrude through the external os as a cherry-red mass surrounded by cervical substance. This is usually soft and moveable. Where the polyp is small but higher up inside the uterine body, no abnormality in the fundus may be felt and the tumour may only be detected on dilating the cervical canal and exploring the cavity with the curette, or, better, with the finger. When the tumour is of considerable size, single

and composed chiefly of fibrous tissue, it is felt as a very dense, hard body in connection with the uterus. It is rounded, moves with the uterus and no rhythmic contraction and relaxation of the mass felt. It is non-sensitive but if the examiner happens to catch an ovary between his hand and the tumour, pain on pressure is elicited. Usually the fundus can be felt with this mass attached, but frequently the fundus is so incorporated in the mass that this differentiation is not always easy. Where several tumours are present, each nodule will present the above characteristics and a number will render the diagnosis more easy. If the tumour is composed chiefly of muscular elements, the mass will be softer and is frequently mistaken for pregnancy, and it must be remembered that degeneration of the tumour may cause the formation of cysts, in which case fluctuation is detected rendering the diagnosis much more difficult. If the growth is large enough to have risen well up into the abdomen, palpation will teach you that it is very hard, the surface may be smooth and evenly rounded or it may be nodular, and it may dip down into the pelvis and is usually mobile. Percussion gives a dull note over its entire surface. The elevation of the abdominal wall from the pubes takes place abruptly while its descent towards the sternum is gradual.

Diagnosis. Uterine fibroids must be diagnosed from free ascitic fluid in the abdomen, tumour of some abdominal organ, ovarian growths and pregnancy, the latter being a common cause of difficulty, but in the sub-mucous variety the symptoms will usually enable one to make a definite diagnosis of fibroid.

In ascitic fluid, disease elsewhere is usually found, as in the kidneys, liver, heart or malignancy or tuberculosis of the peritoneum. The abdomen is swollen but flat, with bulging in the flanks. Palpation produces the fluid wave of impact. Percussion reveals dullness in both flanks, the upper one becoming clear when the woman is turned on her side. On assuming the sitting or erect posture, a dull note will be found in the lower abdomen while the upper part gives a clear one.

When the tumour springs from some abdominal organ, a history of disease of the organ may be obtained. The

fingers of the palpating hand may be passed all around it and its attachment to the liver, spleen or kidney often be detected, while in the case of a uterine growth the mass is in the lower abdomen and may be traced to the uterus.

Ovarian growths are usually cystic and lie towards one side of the lower abdomen. Even where they almost fill the abdominal cavity, they tend towards one side. Usually the tumour can be separated from the uterus bi-manually.

Frequently, it is very difficult to diagnose a fibroid tumour from pregnancy when one has not seen the patient previously, and cases at times require the utmost care to distinguish between the two conditions. It may be necessary to keep the patient under observation for some weeks before arriving at any conclusion. When the woman is pregnant one can usually obtain a history of such a condition, but sometimes the patient will deliberately deceive the medical man, when desirous of concealing the true condition. On examination, the usual signs are observed. The breasts are enlarged, the areolæ darkened and colostrum can be expressed. The abdominal swelling is ovoid, lies in the mid-line, has a smooth surface and is mobile. Prolonged application of the hands enables one to feel the rhythmic contraction and relaxation of the uterine wall and the movements of the child itself, but these movements may be so weak as to necessitate stimulation by cooling the hands before placing them on the abdomen. The uterine souffle and fœtal heart sounds are to be heard when the uterus contains a living fœtus, whereas they are absent, of course, in the case of fibroid. Careful palpation of the abdomen, enables the infant's parts to be felt through the abdominal and uterine walls. On making a vaginal examination, the vaginal mucosa is seen to be congested and of a dark colour, the cervix is soft in its entire circumference and ballotment can frequently be elicited.

Changes, Complications and Degenerations. Fibroids, like all other abnormalities of the body are apt to undergo changes and degenerations of various kinds. Of these, hyaline is the most common. It may be so extensive as to form distinct spaces, imparting a cystic character to certain areas of the tumour, spoken of by some as "cystic degenera-

tion." Obstruction to the circulation, often causes a transudation of serum into the tumour substance, producing an œdematous condition. In some cases, calcareous particles are deposited in the capsule or throughout the actual substance of the tumour, forming calcareous plaques or nodules, but the whole growth rarely becomes ossified. In other cases, the tumour elements undergo a change into fatty tissue, causing the growth to become rather softer and its cut surface to present a yellowish colour. Necrosis often follows interference with the blood supply of the mass. Where no infection takes place, the tumour simply disintegrates, causing but little, if any, general disturbance, in which case the condition is spoken of as "necrobiosis." At times, however, the woman who is the subject of this condition feels below par and the tumour becomes painful and, at times, of softer consistence. If germs do manage to reach the necrosing growth, an abscess formation is set up with the usual symptoms of pain, fever and local tenderness.

A comparatively common change is for the fibrous tissue to become sarcomatous, Winter stating that no less than four per cent. of myomatous tumours become sarcomatous. While carcinoma cannot start from the tumour substance itself, it containing no histological elements favourable to such formation, it not infrequently becomes implanted on a previously existing fibroid from some neighbouring tissues. In nearly 5000 cases collected by Kelly and Noble, cancer of the cervix was found in one and one-quarter per cent. and in the fundus in one and one-half per cent.

Any pedunculated fibroid, whether sub-mucous or sub-serous, may have its pedicle become twisted so as to become necrosed from interference with its blood supply, or the torsion may be so acute as to cause complete separation of the growth. In such a case, if it is sub-mucous, it simply comes away, but in the sub-peritoneal variety the twisting may be very gradual and the tumour become attached to some other structure from which it will receive its nourishment, so that its original location is only discovered with considerable difficulty.

After the establishment of the menopause, fibroids tend to become smaller and in a few cases they entirely disappear.

This also takes place, and more actively and often, after the termination of pregnancy.

Treatment. Should every fibroid tumour which one finds receive treatment? This is a mooted question. Some authors hold that, just as all ovarian tumours are removed as soon as discovered, so all fibroids ought to receive the same treatment. It must be remembered that they are frequently discovered when looking for some other pelvic condition, the tumour having given rise to no symptoms. When that is the case, it is best to ignore the presence of the growth and to say nothing about it to the patient, but it is well to inform the woman's husband or nearest relative for one's own protection. However, where a uterine fibroid is giving rise to any symptoms, either mental or physical, as where the patient is worried over its presence, it ought to receive some kind of treatment directed to its cure.

There are two methods of treating uterine fibroids, *vis.*: operative and non-operative. Where the woman's condition does not warrant any extensive operation, palliative methods are to be employed. Her debilitated condition is probably due to loss of blood, so that the first indication is to combat that. The patient must be put to bed at complete rest and be given treatment which will check the loss of blood. It will be well to give her a sedative of some kind to quiet the circulation, and one of the best of these is heroin, giving $\frac{1}{10}$ grain hypodermically every five or six hours as indicated. Some preparation of ergot, or its active principle, ergotine, may be used, but these often aggravate the condition. Pituitrin, in doses of 0.5 cubic centimeters, is often beneficial. This is best administered by injection deep into a muscle as it is then much less irritating than when injected more superficially, and may be repeated thrice daily for three days if necessary. Quinine or cotarnine hydrochlorate ("Stypticin") in $\frac{3}{4}$ grain doses every four hours, either alone or combined with some other previously mentioned drug will often be found to be efficacious. The coagulation of the blood is favoured by the administration of horse-serum subcutaneously or by giving calcium lactate by mouth. A good form of treatment, is to order a capsule containing: calcium lactate, ten grains, ergotini, one grain; two capsules

to be taken as a first dose and then one every four hours for six doses. If the calcium is used for too long a time, it loses its effect.

Local applications to the interior of the uterus are sometimes employed. Of these, the favourites are tincture of perchloride of iron, carbolic acid, adrenalin and alum, either in a saturated solution or as the dry powder.

Where the above methods fail, recourse must be had to some more active measures. As the blood comes from the abnormal endometrium, this may be removed by curettage, which may be repeated every two or three months, according to indications, until the woman has recovered sufficient strength to undergo some form of curative operation.

Of late years, radium and the X-rays have been added to the armamentarium of the gynæcologist and each has its place, but only as an adjunct to surgery. Neither should be employed where the tumour is the size of a three months pregnant uterus or when malignant disease cannot be excluded with absolute certainty. Nor ought they to be used in young women, on account of the danger of the production of sterility. In the older females they are useful in checking hæmorrhage and some enthusiasts claim that cures may be obtained by these means but it must be remembered that fibroids of the uterus tend to shrink spontaneously after the menopause. A combination of the two is recommended by Weibel, who leaves 50 milligrammes of radium in the posterior fornix for forty hours and in conjunction with this uses sixteen fields of X-ray for ten minutes each. He claims that failures to check hæmorrhage are almost nil, although a repetition of the treatment is sometimes required to secure a perfect result. Other radiologists prefer the intra-uterine application of the radium.

Where the tumour is extremely large, advantage may be taken of the knowledge that many fibroids diminish in size after the menopause. Therefore, if a woman cannot stand a prolonged operation and something rather radical has to be attempted, the removal of both ovaries will often produce the desired result. This operation is especially valuable when there is dangerous pressure, for example upon the urethra causing obstruction to the outflow of the urine, the tumour

at times rapidly and markedly shrinking after operation, but on account of the improved technique of modern surgery this is rarely resorted to at the present time.

The radical treatment of fibroids consists in either removing the tumour without the uterus or taking away both the uterus and growth at the same time. When the latter operation is chosen, two things are to be considered, first the treatment of the appendages and secondly the condition of the cervix. Where the ovaries are healthy and the patient has not passed the menopause, one or both should be left. If, for technical reasons, it is found necessary to remove them both, one may be implanted either in the body of one of the recti muscles, where it will receive the best nourishment, or one broad ligament may be split and the ovary buried in the substance of the ligament. This will preserve the secretion of the ovary and so postpone the menopause and also lessen its effects when it does appear.

Now and then, a woman presenting the usual symptoms of a sub-mucous fibroid, will call on the physician. On examination, a small fibroid polypus will be found to be protruding from the external os, while the uterus gives no further evidence of fibroid disease. In such a case, sterilise the vagina and grasp the polyp with a strong tenaculum forceps and gently but persistently twist it off. This may be done in the office without fear of any untoward result. It is not painful and never gives rise to bleeding of any consequence. If there is any hæmorrhage at all, it can readily be controlled by the local application of any styptic. This simple treatment will save many a woman much ill-health and unnecessary mental perturbation.

Where the polyp has a broader base or is inside the cavity of the uterus, a more extensive operation is required for its removal. With the patient anæsthetised and in the lithotomy position, carefully sterilise the vagina and the external parts well out from the field of operation. Empty the bladder by a catheter and expose the cervix by a perineal retractor. Grasp the posterior lip of the cervix by a strong pair of curved tenaculum forceps and draw it down as far as possible. Now determine the lower limit of the bladder by a sound introduced into that organ. Make an incision through

the vaginal mucosa across the anterior lip of the cervix just below the vesicle attachment and dissect the bladder well up from the anterior surface of the uterus. The cervix and anterior wall of the uterus are then split in the middle line as far up as is necessary to allow of access to the pedicle of the tumour. This is then dissected away from the uterine wall and the remaining cavity closed by a continuous catgut suture, after which the edges of the divided uterine tissue are brought together by interrupted sutures of the same material and the incision in the vaginal mucosa closed in a similar manner. The uterine cavity is now douched with normal saline solution to remove any blood or detritus and the vagina is lightly packed with gauze.

If the tumour is sub-mucous and sessile and situated in the lower part of the uterus, it may be removed by a similar procedure to that described for the intra-uterine polyp, but if it is larger than a two months pregnant uterus, it is better to attack it through the anterior abdominal wall, the operation being termed "myomectomy." In this case, place the woman in the Trendelenberg position with the table so placed that the best possible light will be thrown into the pelvis when the abdomen is opened. The abdominal wall is carefully sterilised from the pubes to well above the umbilicus and from one side to the other, and the bladder emptied by a catheter. The incision through the skin and subcutaneous tissue is made in the median line between the pubes and umbilicus, making it as long as necessary for the comfort of the operator, which will depend upon his skill and the size of the growth. Control all hæmorrhage in the subcutaneous tissue by means of forceps, it being rarely necessary to place ligatures on any vessels. The rectal fascia is then incised so that the sheath of one muscle is opened up. Separate this muscle from its fellow of the opposite side, using the fingers or the handle of the scalpel for this. The sub-peritoneal tissue is dissected through until the shining peritoneum is exposed. This is caught by two pairs of forceps, one on each side, and an opening in it is made between the two. The greatest care must be exercised not to include the bowel in the forceps or it will be wounded. Once the abdominal cavity is opened, the bowel and omentum will fall

away from the anterior wall and the incision may then be enlarged by a small pair of bandage scissors. The intestines and omentum are then pushed well up into the abdomen and retained there by large tape gauzes, each tape being caught by forceps to prevent it from entering the peritoneal cavity. The uterus and tumour are then brought up as well as possible into or through the incision and held there by strong tenaculum forceps. Some operators drive a broad bladed corkscrew into the substance of the tumour and steady it by that means but the forceps are at least as good and may be used in other steps of the operation, thus diminishing the number of instruments required. An incision is made over the most prominent part of the tumour where there are the fewest blood-vessels. It is carried through the uterine wall, down to and through the capsule of the tumour, which may then be readily shelled out by the fingers or some blunt instrument, as the handle of the scalpel. If the bleeding is excessive during this procedure, an assistant can control it by compressing the uterine arteries through the broad ligaments. At times the tumour is covered by a comparatively thick layer of uterine muscle, from which free hæmorrhage is seen. This is best checked by grasping the whole thickness of the uterine wall surrounding the bleeding points by strong double toothed tenaculum forceps, which may remain *in situ* until ready to insert the sutures. Now palpate the whole uterus carefully to make sure that no other fibroids are present, and if there are any they can usually be treated in a similar manner. After all have been excised, close each cavity with care so that there will be left no dead spaces in which blood or serum can gather, as any such collection favours sepsis. This object is attained by using one or more layers of continuous catgut sutures. When each cavity is closed, the divided peritoneal edges are inverted by interrupted sutures of the same material. The pelvic cavity is wiped clean, the field of operation carefully scrutinised for any bleeding points which are to be secured if present, and the tape-towels are removed from the abdomen. The incision in the abdominal wall is now closed by three separate continuous sutures of catgut, using one each for the peritoneum, the rectal fascia and the subcutaneous

tissue. The edges of the skin are now united by a subcuticular stitch of silkworm-gut. By means of a straight needle, this is inserted through the skin at the lower end of the incision and brought out in the incision. It is then carried across from one side to the other until it finally emerges through the skin at the opposite end of the cut. In going up the wound, care must be taken to pass it just beneath the actual skin, in a sweeping manner outwards, so as to secure a substantial amount of tissue in the stitch, and finally not to cross to the opposite side too acutely, as this would kink the suture and render its withdrawal more difficult. The incision is dusted with dry boracic acid and the ends of the silkworm-gut tied loosely over several layers of gauze so as not to produce tension on the skin, which would favour sloughing. A good layer of absorbent cotton is placed over this and the whole dressing kept in place by strips of adhesive plaster applied firmly. The wound will not require to be disturbed until the stitch is removed on the twelfth day, unless there is some special indication. This may be considered a long time for a stitch to be left in place but by that time the gut will be found to have become comparatively free and so can be more readily withdrawn than if it is attempted earlier.

It is always best to leave the uterus *in situ* if the woman is in the child-bearing age, as a myomectomy has absolutely no ill-effect upon a subsequent labour or pregnancy. Large tumours have been removed and yet the patient has subsequently given birth to children without any special trouble during the whole pregnancy or delivery.

Where for any reason the removal of the uterus has been decided on, the question of what to do with the cervix comes up. Should it be left in the pelvis, or ought it to be removed? Where it is in any way abnormal, as inflamed or lacerated, it ought to be taken out, but when it is quite healthy most operators are satisfied with amputation of the uterus at the level of the internal os. It must always be remembered, however, that the cervix is the seat of seventy-five per cent. of all uterine cancers, so the patient's family history regarding malignant disease may influence one's decision. In fact, Richelot and Tuffier both maintain that total, or pan-hyster-

ectomy, is preferable to myomectomy, unless the fundus can be left in condition fit for pregnancy, on account of danger of the subsequent development of cancer. The old argument that the cervix was the key-stone of the arch, and therefore should be left, is untenable, as the roof of a soft arch cannot be secured by any key-stone. The cervical stump rather tends to weigh down the roof of the vagina, if left to itself, but shortening of this passage will be prevented by suturing the stump of each broad ligament to the cervical flaps or, if the cervix has been removed, to the vaginal walls.

Where the tumour is very large, involving the greater part of the uterus, or there are very many nodules present, hysterectomy, removing the uterus with the tumours, is indicated. After preparing the patient and opening the abdomen and packing off the pelvic cavity with tape-gauzes as before, lift the uterus through the incision if possible. Pass a double ligature (all ligatures used will be catgut except the subcuticular suture, which will be silkworm-gut) through one broad ligament just below the tube. The ligatures are drawn well apart so as to leave as much tissue between them as possible. One is tied around the Fallopian tube and round ligament close to the uterus, while the other embraces these structures nearer the pelvic wall. The tissue is then divided between the two, leaving a good button on the uterine side of the outer ligature to guard against its slipping. Continue the division of the broad ligament as far down as may be possible without endangering the uterine artery. A similar procedure is carried out on the opposite side of the pelvis, both ovaries being left if healthy. If either ovary is to be taken away, the outer ligature is passed around the broad ligament to the distal side of the ovary and the ligament is divided between the ovary and the ligature. The fundus is then drawn well back, so as to expose the utero-vesical pouch. The situation of the reflexion of the peritoneum from the fundus to the bladder is indicated by a whitish line. An incision is made joining the lower extremity of the division of each broad ligament and passing across the front of the uterus just above the vesical attachment. The flap of peritoneum forming the utero-vesical pouch, together with the bladder, is dissected off the anterior surface of the uterus

and upper part of the vagina. Each uterine artery is sought for where it approaches the uterus and ligated and, after they are both secured, each is divided in turn. Before doing so it is well to have a strong clamp in readiness to grasp any vessel which has been missed by the forceps. The lower part of the broad ligament is now pushed well out from the cervix and vagina, thus avoiding any danger to the ureter. The fundus is now drawn toward the pubes and a flap of peritoneum dissected off the posterior surface of the cervix and upper part of the vagina. When the cervix is to be left, one side of it is caught in a tenaculum forceps to steady it and it is cut across in such a manner as to leave a V-shaped cavity and the uterus is removed. The cervical flaps are brought together with a continuous suture and the stump of each broad ligament is attached to the remains of the cervix, after which the anterior and posterior peritoneal flaps are united so as to leave no raw surfaces to which adhesions could form. If the cervix is to be removed, instead of cutting it across, thrust the knife through the anterior vaginal wall and divide it all around the cervix, thus entirely freeing the uterus which may then be lifted out of the abdominal cavity. The vaginal flaps are united by a continuous suture, the stumps of the lateral ligaments attached to them and the whole field of operation covered by uniting the anterior and posterior flaps of peritoneum. The pelvis is now wiped dry and any bleeding points which are found are secured. The tape-gauzes are removed and the abdominal incision closed in layers. Some operators, in addition to suturing each division of the abdominal wall, insert two or more stay sutures through the whole thickness of the wall in order to prevent the possibility of rupture of the wound before complete union has taken place, but in an experience of nearly thirty years the writer has never found this to be necessary. The greatest care, however, is taken to secure exact apposition of the edges of each layer and also of the different layers to each other and that there are no bleeding points in the walls of the incision.

After all major operations upon the pelvic viscera which are performed through the anterior abdominal wall, it will be found that the patients make a much better recovery,

both immediate and permanent, if they are kept in the recumbent position for from nineteen to twenty-one days after operation. In most cases, there has been considerable destruction of tissue and dislocation of parts and it takes time for these to heal properly and to become accustomed to their new relations. Many also produce considerable shock to the nervous system, for recovery from which a considerable period of rest and quiet is necessary.

TUMOURS OF THE OVARY.

The ovary is divided into the öophoron, or part containing the ova, and the par-öophoron, of which, as one would imagine from its superior activity, the former is the most important from a pathological point of view. From it are derived the fibromata, myomata, sarcomata, carcinomata, cysts, adenomata and dermoids. The papillomatous cysts spring from the par-öophoron and from the parovarium are developed thin walled unilocular cysts. Of the above tumours, cystomata form about ninety-five per cent. and most of these are of the multi-locular type.

For the benefit of the general practitioner, these tumours may be classified as benign or malignant, any variety occurring during middle life. The benign tumours comprise the fibroids, myomata, ordinary cystadenomata, and dermoids, while the malignant ones are the carcinomata, sarcomata and malignant papillomata. Of these, the two first have been considered, leaving cystomata and malignant papillomata to be described.

Ovarian Papillomata. Papillomatous cysts of the ovary are simply cysts of that structure containing papillary masses, although in one variety the papillæ project into the peritoneal cavity and not into that of the tumour. The papillæ may be few in number or completely fill the cavity of the tumour, multiplying so rapidly at times as to cause rupture of the cyst. They are pedunculated and vary from simple papillæ to complicated branching processes, which may be either white or of a pink colour, the latter depending on the number of blood-vessels present. The tumour is usually soft but may contain sand-like bodies which cause the growths to

feel gritty. When they have perforated the cyst wall, they are liable to affect neighboring structures. The cyst usually contains a clear, thin, watery fluid of a yellow colour and alkaline reaction with a specific gravity of 1005 to 1040 and which does not coagulate on standing. It responds to tests for albumin. The microscope reveals the presence of epithelial elements, compound granular bodies and, sometimes, cholesterin and hæmatoidin crystals. In some cases, the fluid may be dark and turbid or even grumous and the mother cyst may contain daughter cysts, in one of which the contents are dark and turbid, while in another they will be clear and thin. The wall of the cyst consists of three layers, an outer one which is thin and is composed of laminated tissue, a few cells and sometimes non-striped muscle. The next layer is thicker in texture and contains more cells than the former. There are blood-vessels in both of these layers. Internally is a stratum of epithelial cells which may be of any shape and may or may not bear cilia. It usually rests upon a thin basement membrane. The stroma of the cyst wall is continued up into the papillæ, into which it carries blood-vessels, which are thus able to pour out serum into the cavity of the cyst. The previously mentioned sand-like bodies are called "psammomata" and consist of concentric rings of carbonate and phosphate of calcium.

Papillomata may extend from their primary site by any one of three methods, *viz.*: by direct extension to contiguous structures, by fragments broken off from the papillæ attaching themselves to other objects or, lastly, by true metastatic formation.

The diagnosis of the pathological nature of papillomatous cysts before operation is impossible, but Freund considers that the simultaneous appearance of ascites and hydro-thorax is presumptive evidence of ovarian papillomata.

The *symptoms* may not be manifest until the disease has been present for some time. The patient will usually complain of a dragging pain in the lower abdomen, probably more to one side than the other, together with enlargement of the abdomen, the latter increasing rapidly in size. On examination of the abdomen, a cystic tumour is felt to one side in the lower quadrant. Percussion will give a dull note

in the flanks, which dullness moves with the position of the patient. When the growth is malignant, the patient will be thin and emaciated.

The only treatment is removal, intact if possible, through an incision in the anterior abdominal wall.

Fibromata and Myomata. Both of these tumours are extremely rare and are seldom pure fibrous tissue, usually being mixed with muscular in the same tumour. They have a similar structure to those occurring in the uterus. The whole ovarian stroma may be replaced by the growth or it may be spread out over the surface, but in some cases it is in the form of a pedunculated mass attached to the surface of the ovary. This disease attacks but one ovary as a rule.

The *symptoms* are often absent until the tumour has been present for a considerable time. When they do manifest themselves, the woman complains of a dragging pain in the pelvis, painful menstruation and enlargement of one of the lower quadrants of the abdomen. Ascites is frequently present but this is not a constant symptom. The growth being freely mobile is liable to have the pedicle become twisted with the usual symptoms accompanying that condition, *viz.*: pain, tenderness, rapid increase in size of tumour, elevation of temperature and rapidity of pulse. The torsion may be so acute as to cause complete separation of the tumour. A local examination of the pelvis reveals the presence of a hard, rounded mass to one side of the uterus, the tumour being very mobile but not sensitive.

The only treatment is removal as it is apt to take on sudden and rapid growth and is very difficult to diagnose from ovarian sarcoma.

Ovarian Cysts. Cystomata of the ovaries may arise from the infolding and downward prolongation of the germinal epithelium covering the ovary or from enlargement of follicles which have failed to rupture, this failure being due to the thickness of the outer coat of the ovary. Herman said that the latter theory is "such a simple and natural way of explaining the development of ovarian tumours that one would think any other must apply to exceptional cases," and there is much wisdom in this statement. It is not known why some follicles remain small while others grow to an

immense size. These cysts may be seen at any age or in any condition of life, but women who have had small families are supposed to be especially liable to them. The size varies from that of a hen's egg to the cyst reported by Knight, the tumour weighing 111 pounds while the patient herself turned the scale at 87 pounds after the removal of the growth.

Hydrops Folliculi. This is where one or more ovarian follicles becomes distended with fluid, forming a tumour the size of a cherry and globular in character. Several of these may project from the surface of the ovary, producing a grape-like mass attached to the ovary by a pedicle. This mass receives the name of Rokitansky's tumour, is quite rare and, when present, affects both ovaries.

Neoplastic Cysts. Most ovarian cysts are of the proliferating variety and are of two kinds, according to the nature of their contents. One contains a thin, clear, serous fluid and so is called a "serous cyst," while the contents of the other are dark and turbid and contain a substance called "pseudo-mucin," which gives rise to the term "pseudo-mucinous cyst."

These pseudo-mucinous cysts form the greater number of cystic growths of the ovary. They are unilateral and vary in size from that of a hen's egg to a mass weighing between 240 and 250 pounds, but now it is most uncommon to meet with one which is more than thirty pounds in weight, as they are usually removed as they are discovered. No age beyond puberty is free from liability to the occurrence of these tumours but they are more often seen in sterile or unmarried women between the ages of thirty and forty-five than in younger females or those who are the mothers of large families. In shape, they are usually ovoid with a surface which is either even or else lobulated, the latter being most common in small tumours containing subsidiary cysts, called "daughter cysts." The colour is bluish or purplish white and they have a glistening surface with blood-vessels coursing over it. At times, bands of unstriped muscle run over the surface with patches of ovarian tissue flattened out on them.

When the tumour is opened up and the inside examined, the cyst may be found to consist of a single sac, but careful inspection usually reveals bands running through it or over the walls, these bands being the remains of daughter cysts which have ruptured. When several loculi are present in a tumour, their contents may vary from ordinary thin, serous fluid to a substance of a gelatinous nature, which is viscid and requires to be scooped out by the hand. If the tumour is large, the inner surface of the sac is generally smooth, the internal pressure causing atrophy of the epithelium, but in the smaller cysts small papillæ and other excrescences may be observed. This lining is composed of cylindrical epithelial cells, implanted on a basement membrane which is composed of fibrous, ovarian and, sometimes, unstriped muscle tissue, the whole being covered by germinal epithelium.

Serous cysts are much less common and not so large. Externally, they resemble the pseudo-mucinous variety but have a greater tendency to become adherent to the bowel or other neighboring structures. They are usually multilocular but contain fewer subdivisions than the first variety. They contain a clear, thin, yellowish fluid, with a large proportion of albuminous material in it, this being produced partly from the blood-vessels and partly by the epithelial lining of the cyst. The wall is composed of similar elements to that of the pseudo-mucinous variety, the epithelium being columnar and ciliated.

The Symptoms of Ovarian Cysts. The patient may simply have a feeling of weight or fullness in the lower abdomen, or her first knowledge that there is anything wrong may be the appearance of a swelling in the abdomen below the umbilicus. This may produce no interference with menstruation, so that when this suddenly ceases one should be on guard in case that the condition is one of pregnancy. At times, however, the flow is increased, in which case endometritis will usually be found to be present.

The physical signs will vary with the size of the tumour and the nature of the contents. Where it is sufficiently small to be confined to the pelvis, bi-manual examination will reveal the presence of an ovoid, tense, cystic swelling to one side of the uterus, but it may lie in the middle line, in

either case a downward bulging of the vaginal fornix being produced. When the tumour has risen out of the pelvis, it rests upon the brim, in which case the uterus will be depressed in the pelvis and readily reached by the examining finger. Inspection of the abdomen, shows an enlargement in its lower half, usually to one side of the middle line, this enlargement being either evenly ovoid or nodular. Upon palpation, the mass is felt to be tense but fluctuating, although when the contents are of a gelatinous nature a soft doughy sensation, similar to that found in uterine myomata, will be imparted to the hand. If the cyst is unilocular, or has one loculus which is much larger than the others, with a very thin wall, a thrill may be obtained by flicking one side with the finger while the other hand is pressed firmly against the opposite side of the abdomen. This impact may be intensified by causing an assistant to produce firm pressure with the side of one hand over the centre of the swelling. Percussion will show that the intestines are pushed well up in the abdomen and also outwards to each side, the flanks usually giving a clear note, except in the case of a very large growth filling up the whole of the abdominal cavity. Auscultation gives a negative result.

The *diagnosis* is not difficult as a rule when the tumour is small and is confined to the pelvis, the peculiar tense, semi-fluctuating sensation which is imparted to the examining finger by an ovarian cyst being felt in practically no other condition except hydro- and hæmato-salpinx or encysted peritoneal fluid. In the two first named conditions, the mass is elongated or sausage-shaped instead of being ovoid, while encysted peritonitis does not present the well defined outlines of a cyst. Of course, a par-ovarian growth may be mistaken for an ovarian cyst but a differential diagnosis is not essential as the treatment is similar in both cases. After it has risen out of the pelvis, it may be mistaken for ascites, distended bladder, some form of uterine growth, cyst of the mesentery, some renal condition, a phantom tumour or pregnancy with hydramnios.

In ascites, unless it is encysted, you will obtain a history of some disease of the heart, liver or lungs which might produce the intra-peritoneal fluid. The flanks will be seen

to bulge outwards and the swelling does not stand up prominently, as in the case of an actual tumour. Percussion gives a clear note over the centre of the abdomen with dullness in the flanks which will disappear from the uppermost loin when the woman lies on one side.

A distended bladder occupies the middle line of the lower abdomen, appearing as a pyramidal mass above the pubes. There is generally dribbling of urine and careful catheterisation of the bladder will clear up all doubt as to the condition present.

Uterine tumours are hard and palpation fails to elicit fluctuation. It moves with the uterus and the cavity of the latter is enlarged. If the tumour is one of the interstitial or sub-mucous varieties, the menstrual flow will be increased. In the case of a fibro-cystic tumour of the uterus, fluctuation may be obtained if the degenerated portion is large, but the growth can usually be found to be connected with the uterus and the condition is extremely rare.

Mesenteric cysts lie in the centre of the abdomen and percussion gives a clear note all around them. Careful deep palpation does not reveal any pelvic connection.

Any enlargement of the abdomen caused by renal tumours will have proceeded from above and downwards to one side. Here again deep palpation will prove of value in excluding any pelvic connection and in tracing the tumour down into one or other flank.

True phantom tumours are very rare and will disappear completely when the woman is deeply anæsthetised.

In pregnancy with hydramnios, the history will usually be found to be sufficient, but where in doubt the action of the uterine wall will furnish valuable information, as, in the case of gestation, rhythmical contraction and relaxation will be felt, this being absent where the mass is an ovarian cyst. You also will feel the fœtal movements and hear the child's heart. The cervix will be soft and the vaginal mucosa discoloured, although there may be some congestion of the vagina in the case of any tumour pressing upon them.

Complications of Ovarian Cysts. Any organ in the body may become affected synchronously with the occurrence of an ovarian cyst, but the complications most frequently en-

countered are albuminuria, ascites, adhesions, pregnancy, rupture of tumour and torsion of the pedicle.

The co-existence of pregnancy and ovarian cyst produces a most grave condition and requires great care before, during and after labour. If the tumour is large, abortion is very apt to result. The tumour may rotate, causing torsion of the pedicle, owing to some change in the intra-abdominal pressure. This is sometimes followed by infection and supuration of the cyst. When the pregnancy goes on to full term, the foetal and maternal mortality is high. In 271 cases of ovarian tumour complicating labour, the maternal mortality was found to be twenty-five per cent. and that of the foetus seventy-five.

Torsion of the pedicle is not uncommon, especially in cases of dermoids, probably on account of the difference in the density and weight of the various parts of the tumour. The symptoms of this complication are the sudden onset of an acute pain in the lower abdomen, followed by rapid increase in the size of the tumour due to obstruction to the return circulation causing an exudation of blood into the cavity of the cyst. The abdomen becomes tender and the woman may show evidence of profound shock, the respirations becoming rapid and the pulse small, thready and rapid with a subsequent rise of temperature. When the onset is more gradual, there may be few or no special symptoms, but the pain will be increased. The only treatment is to remove the tumour by an abdominal section.

Rupture of the cyst may occur and be followed by its complete disappearance or it may refill. When the contents are either of an irritating nature, as in the case of a dermoid, or malignant, general peritonitis or secondary infection of the peritoneal cavity may take place.

Nervous and Mental Diseases

BY

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Nervous and Mental Diseases.

INTRODUCTION.

LOMBROSO, who was sometimes right, claimed for men of genius, longevity. He believed their diminished affection and their apathy toward many things in life, served as a shield from the worries that harass the minds of less gifted men. Obviously, the state of undue solicitude makes for unhappiness, promotes disease and shortens life, and the belated regret of an aged man should be an admonition to others. He said: "I am an old man and have had many troubles, but most of them have never happened."

That even middle life does not take sufficient care of itself is abundantly shown by the many lives which through nervous disorders and diseases have burned out before their time. If one may believe their biographers, Dickens died at fifty-eight, of apoplexy; Shakespeare at fifty-two, of some nervous disorder, while the average life of his brothers and sisters—there were eight in all—was less than thirty-two years; Pascal, who had headaches, hallucinations, phobias and convulsions, died at thirty-nine; Burns, who lived in an extremely convivial age, did not learn to control his appetite and so brought himself to the grave at thirty-eight; and Poe, a similar delinquent, died at the same age; Mozart, who was drunken, at times delirious and delusional, died at thirty-six of inflammation of the brain; Byron, against whom the indictment is long, was licentious, a glutton, a sot and perhaps epileptic, and he also passed away at thirty-six; it is said that Chatterton was the most precocious of all literary geniuses—he committed suicide in his eighteenth year.

However, this premature destruction and decay does not prove Lombroso in error, since the list of men who attained advanced life is much longer, and beside those to whom reference has been made lived at a time when hygiene was

little known and less practiced, nor could they avail themselves of present-day scientific prevention of disease and of our many measures for combating sickness when acquired. Since those days statisticians tell us that life has been appreciably lengthened and this despite the fact that we are keeping alive many weaklings who formerly could not have survived.

In nervous and mental diseases, more than in any other department of medicine, is one confronted by the serious problem of heredity; but as yet the prevention of many disorders is not possible by means of the control of parentage, and, therefore, our work in part must at times be the care of individuals who are somewhat handicapped. Often the cause of much mischief dates from childhood at which period neurotic children should receive scrupulous attention in matters of general hygiene; they should not be pampered but should be judiciously disciplined and taught self-control; they should not be subjected to undue strain in the school-room. Exceptional children also should be given special consideration lest their possibilities be thwarted, since the gift of acquiring knowledge so readily leaves them with much idle time, which may be the means of their falling into vicious habits.

A few diseases are directly inheritable, but more frequently in the offspring of bad nervous stock a variety of disorders are found asserting themselves, such as neurasthenia, psychasthenia, hysteria, hypochondria, insanity, epilepsy, mental deficiency, alcoholism and other addictions, eccentricities of character, gross immorality, and even the greatest of moral obliquities, crime. The nervous and mental diseases of middle life are also concerned with such factors as excessive mental and physical strain, since it is at this time that the maximum effort is made; with traumatism, infections, general diseases, poisons, refrigeration, neoplasms, excess or deviation of sexual relations, dysfunction of the endocrine glands; also disturbances incidental to the involutional period of both sexes and in the malconditions sometimes consequent upon an artificially induced menopause.

These numerous affections call for the employment of therapeutic measures that vary widely. Cerebrospinal syph-

ilis must receive prompt, vigorous and persistent medication; sometimes neurasthenia may be overcome without the use of drugs but through the application of rest and other physiologic procedures; in psychasthenia, unless complicated, work need not be discontinued, though often a change is desirable and in addition a hobby should be cultivated; hypochondriacs should not be permitted more than the normal amount of rest but they should be strenuously urged to occupation, including, if possible, a fad; the insane may at times be treated extramurally, as in some of the melancholias, though where expense is an important item and self-destruction is imminent, institutional care is advisable; with paranoiacs who sometimes are so dangerous to others, institutional detention is often imperative; a few alcoholics and drug addicts and many degenerates belong in penal institutions where they are not infrequently found.

There is left a group of individuals who always have been, and always shall be "nervous," but in whom a breakdown may be obviated by the constant observance of common-sense rules of general hygiene, such as bodily cleanliness, suitable exercise, proper work, amusements, fresh air, nutritious food, general sobriety, the avoidance of intimate contact with invalids, and the cultivation of self-control.

Want of space has prohibited more than a brief discussion of the diseases of this period, and but the mere mention of such measures as psychoanalysis, occupation therapy, hydrotherapy, massage, electricity and technical laboratory procedures.

FUNCTIONAL AND GENERAL DISEASES.

NEURASTHENIA.

Neurasthenia, the fatigue neurosis, or as it is familiarly known, "nervous exhaustion," is usually a disease of adults and is perhaps more frequent in men. Occurring in middle life the disorder is somewhat prolonged, since at this time the metabolic and nutritive processes are noticeably lessening in their activity and, besides, the nervous system does not show the resiliency of an earlier period.

Those predisposed to neurasthenia have come of unhealthy ancestors who often, though not necessarily, were subject to disorders of the nervous system. Perhaps the parents were of somewhat advanced age at the time of conception, or the mother during pregnancy may have been subjected to undue stress. Among the many exciting causes of neurasthenia are worry, overwork, lack of sleep, excesses of various kinds, intoxications; and following infections, after accidents, often after surgical operations which may have been entirely successful, and sometimes following heat prostration; organic diseases such as syphilis during the secondary and tertiary stages, fear and worry from knowledge of the disease, dread of infecting others, and occasionally as the result of prolonged and debilitating mercurial treatment; tuberculosis, gout, rheumatism, diabetes and cardiorenal diseases; abdominal ptoses, intestinal putrefaction, affections of the lower bowel such as strictures, fissures and hemorrhoids. In the male, prostatorrhoea. Pelvic conditions and maternal responsibilities in the female; artificially induced menopause and sometimes after menopause proper, which, however, only acts as an exciting cause.

The disease usually appears in one of two forms: Primary neurasthenia, much the less frequent, as the result of an inherent weakness of the nervous system, which develops slowly and which probably has shown evidence of the disorder previous to middle life. Symptomatic neurasthenia, as when it is consequent upon some organic disease, toxic state or trauma.

Primary neurasthenia is characterized by the features of weakness and irritability, which may appear in the motor, sensory, psychic or visceral sphere. The denial of the existence of this form is without justification, since it develops in individuals who have always shifted their responsibilities and who finally break down without adequate strain.

The symptoms commonly met with in neurasthenia are fatigue, backache, headache, irritability, insomnia, muscular tremor, twitchings and exaggerated reflexes; the tongue is coated, there is indigestion, flatulency and constipation, and, occasionally under the strain of worry, mucous colitis; loss

of appetite is by no means a constant finding; palpitation and vasomotor manifestations, with at times a lessening of the secretions, though the opposite condition may be met with. The special senses yield such evidence as exhaustion in the eyelids, blurring of sight, hyperesthesia of the retina, fatigue contractions or fatigue spiral visual fields; also a hypersensitiveness to sounds, tinnitus and throbbing in the ears.

Sometimes the disorder conforms rather distinctly to a type which is described either as a sexual, anxiety, occupation or traumatic neurosis.

Sexual neurasthenia is most common in young men in whom there may be sexual repression, overindulgence or even unnatural gratification; such persons are concerned over pollutions, masturbation, priapism, premature ejaculation, unsatisfying sensation and even the absence of orgasm; neuralgia of the testicles and pain in the inguinal region; a cloudiness of the urine is taken for spermatorrhea. Women complain of sexual dreams, nocturnal orgasms, diminished, delayed or absent orgasm.

Anxiety neurosis was first described by Freud, who separated it from the general group of neurasthenic manifestations, though it could be appropriately described as a psychoneurosis and not infrequently it is a part of hypochondria. Freud maintains that where the etiology cannot be readily ascertained—and then it is usually due to marked hereditary taint—the disorder has its origin in a series of injuries and influences upon the sex life. General irritability and anxious expectation or even fear are present and accompanying these are various bodily manifestations, such as profuse perspiration, dizziness and trembling, diarrhea, vasomotor disturbances, pseudoangina and paresthesias.

Occupation neuroses are confined for the most part to middle life, the subjects are often neurotic, and they have been much more common in men, though the advent of woman is affecting the proportion. These neuroses are as various as are the occupations calling for the repeated action of definite muscle groups, which through overuse assume the symptoms of fatigue, tremor, weakness and cramps, and at times they may even undergo atrophy. Faulty position

at work, previous injuries, general debility, worry and anxiety may be factors. The more highly refined the occupational movement, the more likely is this condition to result. Work requiring a sustained effort of the hand is most conducive to this disorder, so that we have it arising among penmen, seamstresses, violinists, engravers, knitters, and many others; clergymen may have their vocal cords affected, and those whose efforts concern special movements of the feet or back are liable to the disorder in the muscles used. Selecting writers' cramp as illustrative of the type, one finds that when the strain exceeds the individual's capacity, a sense of fatigue is experienced, soon to be followed by tremor, spasms and even cramps; these irregular movements may so involve the arm as to completely incapacitate the individual for his work. The course of the disease varies, but is, as a rule, more or less chronic. In the more pronounced cases the outlook is not so good, since prolonged rest may not lead to complete restoration.

Traumatic neurasthenia is denied existence by a few who believe the resulting condition is invariably hysteria. Certainly the disorder is at times confounded with hysteria, but the more commonly accepted view is that either or both conditions may be encountered in one who has sustained an injury. The continuity of the nervous system as a whole persuades one that when a particular part is subjected to trauma, the effect may be widespread—to the brain, muscles, vessels, glands of internal secretion and to the viscera. The claim is often made that traumatic patients lose their nervous symptoms when they are compensated. But this is not always true, since some of the mild cases remain unduly apprehensive or become hypochondriacal, and the fact that sometimes an individual does recover after he is paid money does not prove that he was never ill. If such individuals have the symptoms of neurasthenia, how can one escape the conviction that they have that disease?

In diagnosis, among the outstanding features are weakness and irritability. Since the disorder is usually secondary, that is, the early manifestation of some bodily disease, this must be sought and if possible eradicated, else the symptomatic neurasthenia cannot be cured. Among the common diseases

to be borne in mind are the cardiorenal affections, syphilis during the secondary and tertiary stages, tuberculosis, hyperthyroidism, hysteria, abdominal and pelvic conditions, melancholia, hypochondria and early paresis.

For the successful *treatment* of neurasthenia, the physician must have psychologic hold of his patient. Profound nervous exhaustion requires the full rest régime, while in the less serious cases modified rest will suffice. Others should have suitable work tempered with recreation, while some may require a change of scene or even of climate. The habits and diet should be regulated and proper exercise taken. Constipation must be overcome and good general elimination established.

Sometimes cold douches to the spine and salt rubs act as a tonic. Local massage and some of the various forms of electricity may be indicated. The diet of neurasthenics is most important and in those requiring full rest much dependence should be placed upon milk. In addition to being highly nutritious, this food has the great additional advantage of exacting but little work from the tired stomach, kidneys and liver. In the few who cannot endure pure milk, the addition of just a little kefir will bring about fermentation, thus rendering the milk much more tolerable. Eggs also are useful in the diet and the judicious addition of chicken, oysters, fish and perhaps a chop or small steak, together with one or more of the well borne vegetables, will enable the physician to carry on the much desired full feeding.

Medicinally, preparations of iron, arsenic and phosphorus are useful and also strychnin in selected cases.

Some special care must be given patients with occupational neuroses. If penmen, the other hand should be used and sometimes a change of work is required. In writing the movement should never be in the fingers, but should always be made with the muscles of the forearm resting upon the desk while the whole arm partakes of the movement. Local treatment should consist of massage, electricity, disciplinary exercises, hydrotherapy and diathermia. The psychoanalytic method finds favor with some when the mental element is pronounced.

PSYCHASTHENIA.

Psychasthenia as described by Janet is a chronic psychosis, fluctuating in intensity, characterized by obsessions, fears, doubts, compulsions, sometimes by dream-states and dissociated personality, with such motor manifestations as tics, and even epileptiform attacks, but without tending toward mental deterioration.

Like its counterpart, neurasthenia, psychasthenia may conform either to a primary or to an acquired type, the latter being the more frequent; it has the same psychopathic or neuropathic antecedents; it may be secondary to many disorders and it may result from trauma, not alone of the head, but also of the body.

The symptoms are preëminently in the mental sphere, in which the mental effect is that of a general disturbance and results only in general inefficiency. The impulses are usually controlled and the hallucinations, phobias and doubts, are recognized as such.

Janet has tabulated over forty distinct phobias, which include: Claustrophobia—fear of closed spaces; agoraphobia—fear of open spaces; mysophobia—fear of dirt; monophobia—fear of being alone; these have been called mental tics and frequently have their origin in emotional shock; here, Freudians claim preëminence for the sexual element. Corresponding to the foregoing are the motor tics, which are spasmodic, more or less purposeful movements, subconsciously induced, and which cease during sleep; different types are facial tics, mental torticollis, winking of the eyelids, shrugging of the shoulders, movements of the abdomen and various other bodily movements, often bilateral, but never symmetrical; the extreme of the motor tics is carpolalia, in which the movement is accompanied by an indecent explosive utterance. They often make their appearance in youth; some individuals feel compelled to repeat certain words or phrases, to touch various things or to step on certain objects which they pass over. Being aware of their absurdities, they may endeavor to conceal them, but this frequently only emphasizes their condition.

Psychasthenia, while sometimes combined with neurasthenia, reveals when alone a less obvious or even a lack of

fatigue, paresthesias, circulatory and alimentary disturbances, insomnia, headache and backache; it is less serious than neurasthenia by reason of its being more dependent upon outside effects. The disorder lacks the anesthetics, paralyzes, contractures, amnesias and subconscious states of the true hysteric, but the two diseases are sometimes associated. A psychasthenic state may precede some of the psychoses, but these mental diseases are usually not long in frankly declaring themselves.

The course of psychasthenia is chronic and relapses are frequent. Usually, it does not amount to invalidism. Men of intellectual endowments and in active work are sometimes so afflicted, but they are not often thereby obliged to lay aside their duties.

Treatment. The primary type is found to be the more resistant. If the disorder is secondary to some bodily disease, this, if possible, should be eradicated. Generally speaking, the treatment is mental. The psychasthenic should be taught self-control, he should be occupied, and sometimes the disorder will respond to a change of occupation. In men who have had to perform prolonged and difficult work, the cultivation of a fad has at times prevented mental breakdown, and in less serious cases has been the means of restoring individuals to their normal equilibrium. The most obstinate cases may be afforded temporary relief through hypnosis. Placebos, hydrotherapy and electricity are all useful. Only when there are exhaustive neurasthenic symptoms present is absolute rest needed. Special types must be given special consideration; for instance, in the motor tics, there may be some local irritation, which, in that event, must be removed; strong faradism will hold the muscles in temporary tonic contraction, and local, systematic exercises are sometimes useful. Selected cases will be remarkably relieved through the medium of psychoanalysis.

HYSTERIA.

Hysteria is a functional neurosis which develops upon a temperamental background when unusual or even ordinary stress in any of its various forms is brought to bear upon the individual, and is characterized by manifestations—often

amounting to attacks—which may appear in the physical, mental or emotional sphere.

The etiological factor of first importance is heredity and when this influence is pronounced, almost invariably there have been manifestations of the disorder in childhood. And let it here be emphasized that even slight mismanagement of a hysterical child may be fraught with dire consequences in later life. An individual of this type should be taught self-control and how to bear more patiently the many petty and unavoidable annoyances in this life. But if such training has been omitted, then the adult must be shown the way of greater submission to things inevitable. After middle life, hysteria is uncommon.

In this disease it is the young adult females who predominate largely, but later trauma yields an increasing number of male hysterics, through their greater exposure, as was forcibly demonstrated during the recent war. Indemnity hysteria also illustrates how trauma may at times act as a factor. School children, congregates and soldiers show the effect of contagion in hysteria. Freudians see sex influence—not essentially sensuous—as the predominating cause of the manifestations—dissociations—back of which is the process called “repression” and this leads to the splitting off of parts of the personality. “It is the fundamental hysterical (conversion) mechanism which throws upon the body, makes it the scape-goat of, the responsibility of our moral failures” (Jelliffe). The views of Babinski have been widely proclaimed. He believes the symptoms are the result of suggestion and that they can be removed by persuasion.

Hysterical persons are emotional, unstable, their mental outlook is not large so they often turn to themselves and become introspective; by reason of their weakness they are always inefficient; in some, suggestibility is so pronounced that unless they are adroitly examined by the physician, symptoms may be induced. The findings in hysteria are largely those of disturbed sensation and motion, amnesias and subconscious manifestations. Sensory disturbances appear as an increase, decrease, loss or perversion of sensation and are characterized by their non-conformance to any nerve distribution—psychic not anatomic. A common form is hemi-

anesthesia which ends abruptly in the midline and which throughout is of uniform intensity though it may vary from day to day; an area may be glovelike or there may be patches with all forms of sensation involved. Hyperesthesia is most familiar as hysterogenic zones, slight irritation of which may provoke convulsions; common sites of such areas are above the ovaries, below the breasts and in the inguinal regions;



Fig. 1.—Hysterical hemiplegia showing flaccidity of the paralysis. (From "Diseases of the Nervous System," by Charles L. Dana, M.D., ninth edition. William Wood and Company, New York.)

any of these zones may be the seat of spontaneous pains; the joints, spine and even the vagina may be hypersensitive. Motor disturbances are of the nature of paralyses, contractions, convulsions and tremors. Hysterical paralyses may be monoplegic, hemiplegic or paraplegic, and often they are accompanied by anesthesia; the affected member hangs limp, the muscle tone and reflexes are not increased nor are there

altered electrical responses (Fig. 1). Peculiar, rigid positions may be assumed by the parts and these are termed *contractures*. When tremors are present, they develop suddenly, are coarse and always intermittent. Sometimes there is inability to stand and walk normally and this is termed *astasia-abasia*, which will be further considered under diagnosis. Convulsions are concerned in the classic paroxysms which are the maximum of hysteric manifestations but which are now seldom seen in their entirety. Charcot and others have divided them into four stages: (1) *Epileptoid*: The onset varies, but soon the patient falls without sustaining injury and then there follows a series of moans, groans or incoherent utterances. (2) *Grand Movements*: A fixed posture is assumed, usually that of *opisthotonos* or possibly *pleurothotonos*, with consciousness disturbed and perhaps profoundly so; then disorderly movements occur, soon to be followed by relaxation and brief rest. (3) *Passionate Attitudes*: Any of the more violent emotions may be expressed. (4) *Delirium*: Here, illusions and hallucinations may be experienced, often with mental excitement which is most likely to be of the character of depression. The whole scene may be enacted in from five to twenty minutes but sometimes the last stage persists for many hours.

Subconscious manifestations are usually present independently of major hysteria. Sleeping attacks, also called *narcolepsy*, sometimes appear quite unexpectedly and these may last for a few minutes or for many hours, which state may deepen into lethargy or even *trance*. *Cataleptic* attacks usually include the whole body, though rarely they are localized; here, the parts remain suspended for a long time in any position in which they may be passively placed; cutaneous reflexes are decreased, tendon reflexes unaltered, and the patient though unable to move or to speak, is sometimes conscious of his surroundings; he may awaken spontaneously and occasionally is responsive to the action of a powerful stimulus. The term *somnambulism* should perhaps be restricted to the manifestation occasionally observed in natural sleep. As the disorder appears in hysteria, it is much more amenable to suggestive treatment. Hysterical psychoses sometimes develop and in adults they are met with almost exclusively

among women. Here, after paroxysms of laughing or weeping, clownism and motor unrest may ensue, together with hallucinations, usually of vision, and these are sometimes attended by raving. Sporadic theft may be committed under hysteric influence. The psychoses which appear are of short duration and are likely to have associated with them some of the more common manifestations of hysteria.

Among the special senses, disturbances of sight are the most frequent; the pupils are usually dilated, they always react—though possibly delayed—to light; amaurosis may be present; when so, it is often bilateral and for the most part incomplete; concentric narrowing of the field of vision is the most common eye symptom; of this there are several types, such as “tubular,” “spiral” and “shifting,” though the last two are also common in neurasthenia; changes in the color field may be noted, and in severe grades an ocular palsy may rarely be simulated by reason of a contracture in its antagonist muscle. Disturbances of hearing, either unilateral or bilateral, may be present, and the senses of taste and smell may also be affected. A hysterical aphonia is not uncommon. Some of the sexual disturbances are exceedingly troublesome in a marital sense, as in anesthesia or hyperesthesia of the vulva or vagina. Vasomotor manifestations may occur in the form of edema, a tendency to unusual hemorrhage or sometimes the opposite state. Then there may be tachycardia, bradycardia, polyuria, and disturbances of the alimentary tract in the form of diarrhea, constipation, vomiting, borborygmi, and meteorism, possibly simulating tumor.

As to diagnosis, hysteria has been taken for almost every disease and most diseases have been taken for it, the former being the more serious error. It should also be borne in mind that hysteria confers no immunity—it is often associated with other disorders. The common diseases of neurasthenia and psychasthenia usually present little difficulty. The differentiation from epilepsy may be necessary. Usually, by recalling that both diseases are sometimes co-existent, little difficulty will be experienced but a few cases are so obscure as to be classed as hysterio-epilepsy. While, of course, both family histories reveal faulty heredity, hysteria

in the process of years, seldom shows a degenerative tendency. The individual may with profit be studied during the inter-paroxysmal period, during the paroxysm and in the post-paroxysmal state. Between paroxysms the patient may show hysterical stigmata—anesthesias, paralyses, contractures, amnesias or dream-states—but lack the epileptic personality—egocentricity, emotional poverty, social inadaptability and mental dullness. The hysterical paroxysm is apt to be precipitated by emotional stress and but rarely is preceded by a short and definite aura. If there is a cry, it is long drawn out and not sharp and shrill. The fall is more of a safe let-down and is unattended by injury of consequence. Unconsciousness is frequently prolonged, seldom profound and often of varying intensity. The color of the face changes but slightly. The inflicting of sharp pain will usually restore consciousness while epilepsy must terminate spontaneously. The pupil is not immobile. Tonic spasms often cause a curving of the body in different positions—opisthotonos, pleurothotonos—and the clonic convulsions partake more of the nature of violent swingings in the extremities and body. It is very doubtful if hysterical convulsions may occur during profound sleep. There is no genuine biting of the tongue or cheeks but occasionally the lips are chewed. The sphincters remain continent. It must be remembered that in the event of malingerings, some of the more characteristic manifestations of epilepsy may be assumed. In the post-paroxysmal stage there is no stupor, nor are automatism, somnolence, headache or exhaustion likely to be met with.

Multiple sclerosis shows exaggerated reflexes, later a true ankle and patellar clonus, often a Babinski sign, optic neuritis and distinct nystagmus; the tremor, if considered separately, may at times be confusing. Brain tumor, particularly in the frontal region, may in the early stage lead to error. I have seen patients, when the previous history was unavailable, in whom the first examination failed to distinguish clearly between hysteria, dementia precox and feeble mindedness. The condition of astasia-abasia which sometimes follows physical or mental shock can also be determined by exhaustion, so that in addition to hysteria the disorder may

occur in neurasthenia, psychasthenia, hypochondria, epilepsy and chorea. When it develops upon a hysterical basis there may be present some of the sensory disturbances common to this disease. Accompanying neurasthenia, there is usually marked fatigue, exaggerated reflexes and paresthesias. The absence of a persistent ankle clonus and the Babinski sign, together with a continent bladder and rectum, would rule out organic disease of the cord. Pronounced incoördination from cerebral and cerebellar diseases is attended by the other common signs of affections of those organs.

Treatment. In individuals of a hysterical temperament abstract states of mind and brooding should be discouraged, and employment such as will hold their attention should be given. If exhaustion is present, the rest-cure may be instituted and at times, even in the absence of exhaustion, isolation is necessary. The personality of the physician and the tactfulness of the nurse are of the utmost importance. Special examinations and operations should be discouraged unless absolutely necessary. Those of a hysterical temperament should not come in too intimate contact with invalids. The psychoanalytic processes, whereby submerged complexes are brought into the field of full consciousness, are useful in the hands of the skilled operator. Sometimes paroxysms may be aborted by bringing about emesis or by causing sharp pain through pressure upon a particular point. All manner of drugs have been used, valerian and bromides being the most common. The suggestibility of the patient affords an opportunity for the successful administration of a placebo and this may be given in the form of a large capsule containing starch. Hypnosis may be used but it is not without very disagreeable possibilities. Electricity and hydrotherapy are often useful as a means of impressing the patient.

EPILEPSY.

True epilepsy is a chronic disease or disorder of the brain, characterized by recurrent and paroxysmal disturbances of consciousness, which are usually attended by more or less pronounced motor manifestations. As encountered in middle life the disease is often a heritage from childhood, but when appearing spontaneously one should always suspect it

of having developed upon a syphilitic, traumatic or toxic basis, or as being symptomatic of some focal condition such as brain tumor.

In type the seizures are usually grouped as: Grand mal: Consciousness is lost, general convulsions ensue and, if standing, the patient always falls; this is known as a major attack or a fit. Petit mal: A minor attack in which consciousness is disturbed and in which the motor manifestations, usually local, are mild. Psychic: A blank in the sphere of consciousness varying from a second to perhaps many days and usually unaccompanied by motor manifestations. Jacksonian: A motor seizure confined, at least at first, to a part of the body, and frequently symptomatic of focal brain disorder; ultimately, the spasm may be masked by a general convulsion, when the disorder presents the picture of the idiopathic disease.

Epilepsy is so common an affection as to occur about once among every four hundred and fifty persons and is more frequent in men as their occupations and habits favor its development. It is probable that seizures develop as a result of cerebral anemia and most confirmed epileptics show many abortive attacks.

While faulty heredity is in many instances a prominent factor the disease is seldom directly inherited, but one finds it cropping out in neuropathic stock along with many other nervous and mental disorders. Additional causes are, birth injuries, infectious disorders which sometimes set up an encephalitis, and occasionally psychic trauma is sufficient to precipitate the disease in a potential epileptic. Among the endocrine disorders the pituitary in particular has been held responsible, and occasionally the thyroid. A personal observation was that of a patient in whom the disorder appeared promptly and was persistent, after the removal of both ovaries. The blood pressure of epileptics usually shows hypotension.

At times no disease declares itself with more certainty than does epilepsy, but occasionally no clinical entity presents a more baffling picture. The scarring at prominent points on the head and face, the slow and monotonous voice, the mental make-up that reveals "egocentricity, emotional

poverty and social inadaptability," together with the expression that betokens mental dullness are all suggestive, and when, with these, there are associated degenerative physical stigmata, one need not observe the cardinal symptom—the disturbance of consciousness—or any other form of psychic, motor, vasomotor or sensory seizure, but may boldly declare for epilepsy. Occasionally, however, the real nature of the disease is much less obvious and then one may be called on to consider the problem in the light of hysteria, alcoholism and other degenerative conditions, major convulsions from toxic states, cerebral syphilis, beginning paresis, brain tumor, aural vertigo, cardiac syncope, reflex epilepsy, spasmophilia, narcolepsy, tetany, anomalous migraine, myoclonus, disordered sleep, or malingering.

Others have stated their ability to forecast epilepsy—anticipate seizures years in advance—by the mental and physical make-up of the individual, but I confess to a lack of such prophetic acumen.

The classic complete seizure begins with a warning which is followed by a cry, the fall and unconsciousness; then come the tonic spasm, clonic convulsions, frothing, biting of the tongue and extravasation of urine; soon consciousness returns, shortly to be followed by sleep from which the patient awakens with a headache, all of which—after some hours—is succeeded by muscular soreness. With an absence of the more important data such as recurring attacks of disturbed consciousness, convulsions, biting of the tongue, wetting the clothes, attacks during sleep or periods of automatism, one should have blood and spinal fluid tests made, an ophthalmological examination and x-ray studies.

Complications sometimes arise, such as status epilepticus which is the maximum and the gravest of epileptic manifestations. Ten per cent. of epileptics are prone to insane periods which are characterized by suddenness of onset and danger through violence, but usually the attack does not last long. Accidents such as fractures, dislocations and severe burns, are sometimes encountered. There is a somnolent form of epilepsy in which attacks occur only during sleep; it has happened to such a patient that he has rolled over on his face in a seizure and smothered in the depths

of the pillow. For fear of drowning, epileptics should never be permitted to bathe when alone. Occasionally, important medico-legal questions arise in connection with this disease.

An epilepsy developing in middle life gives more hope of recovery than that arising at an earlier period. The average life of the epileptic is about thirty years.

Treatment. In the attack, the patient should be placed on the floor, a pillow slid under his head, a towel placed between his teeth and the clothing loosened about the neck. Medicinally, luminal is the drug of choice; other useful remedies are chlorotone, the bromides but in much smaller doses than was formerly used, belladonna, and if especially indicated, antispecific remedies; in selected cases, some of the endocrine preparations will prove of service. Constipation should not be permitted, and attention to general hygiene and dieting are important. Status epilepticus should be met by applying cold to the head, purgation, warm packs, chloral enemata and stimulation.

When there are signs of a distinctly localizing character, surgical intervention is often justified. Where complete restoration is not effected, among the well-to-do the patient may still remain at home, but usually the best place for an epileptic is on a colony farm, while those who show frequent insane periods are safest in insane hospitals.

FIBROSITIS.

In the middle period of life one often meets with chronic muscular rheumatism, a term frequently spoken of with derision, and little wonder when it is recalled that many errors in diagnosis are committed under this name. Yet the condition is one so commonly met with as to have been termed "an every-day affection." For some years past the rheumatic pains so frequently experienced by many have been known to arise from definite "sore spots" in the body and these have as their underlying pathology a condition described by Gowers as fibrositis. In nature this disorder is a low-grade inflammation resident in the fibrous connective tissue, which tissue, it will be remembered, extends throughout the entire body, hence the widespread distribution of the affection.

Etiological factors are gout, intoxication from intestinal putrefaction, infections, pus in any part of the body, and, most frequently of all, refrigeration. Wherever people congregate there are always present some who are particularly susceptible to the mischievous influence of drafts, exposure to which promptly brings about stiffness and soreness in different parts of their bodies. Such individual susceptibility occasions much annoyance and even distress, since doors and windows must remain either open or shut. It cannot be successfully denied that drafts at times are provocative of serious trouble, since all physicians have seen attacks of Bell's palsy so caused, which condition may leave the patient with a life-long paralyzed and deformed face. In those subject to fibrositis, a slight strain in any part of the body may cause pronounced soreness.

The disorder has widespread neurologic significance and already one large volume has appeared, devoted exclusively to this condition. While fibrositis may be met with in any part of the body, the most frequent sites of the disorder are the neck muscles, especially posteriorly; in the back of the scalp and in the temporal region; along the cervical vertebræ, particularly at the points where the muscles are attached; about the lumbar and sacral spine; at the inner sides of the elbows and knees; in the muscles of the abdomen; and in the gluteal region particularly near the sciatic notch, from whence it sometimes extends to the fibrous sheath surrounding the sciatic nerve, and even into the fibrous septa. Here, then, the explanation for quite a large group of painful disorders may be sought with profit, since fibrositis is at times the cause of headache, neuritis, neuralgia, myalgia, lumbago, sciatica, torticollis, intercostal neuralgia, brachialgia, painful feet, etc.

The successful palpation of these thickenings is an art possessed by but few, hence the lack of knowledge—and even incredulity—concerning the disorder. One inexperienced will, in seeking these areas, be aided by the use of a lubricant, since this renders the skin less resistant and then the parts beneath may be palpated with the greatest facility. These thickenings are found present in three stages: 1. A swelling. This is of a soft, yielding consistency and is fre-

quently observed in the bodies of the muscles where a puffiness may be noticed. 2. When a slightly elastic resistance is offered to the touch, as though some organization had taken place. 3. Induration. Here there is an absence of elasticity, and organization has advanced to the stage at which a substance of cartilaginous consistency presents itself to the examiner. These indurations may appear again and again for some time before becoming chronic, but the older they are, the firmer they become and the more resistance they offer to successful treatment.

Undoubtedly the most satisfactory method of removing these areas is through massage, and the successful treatment of fibrositis is proof of the greatest skill in the manual method. Other measures are hydrotherapy, electrotherapy, hyperemia and special exercises, while a few selected cases will be found to respond to vaccinothrapy. All foci of infection, such as offending tonsils and abscesses upon the roots of the teeth, must be eradicated. Where the disorder has developed upon a gouty basis, the diet should be carefully regulated. Active elimination is often necessary and this may be accomplished through free use of some of the well known laxative waters, hydrotherapy and diuretics. The drugs most helpful are aspirin, atophan, and sodium salicylate, with the employment of small doses of iodides in the more protracted cases.

HEADACHE.

Headache or cephalalgia is the most common symptom met with in the practice of neurology, since many men and most women have the affection occasionally, if not more frequently. The intellectual, the wealthy, and particularly the metropolitan population, are inclined to the disorder, and it varies somewhat with seasons, being rather more common in spring and fall. Exclusive of migraine, which is considered separately, the affection is overwhelmingly symptomatic.

Upon an anatomical basis, headache is due to irritation of the trifacial nerve branches, or of the sympathetic fibers which are distributed to the dural membrane and to the intracranial blood-vessels. However, as Gowers remarks, the cerebral substance itself under abnormal conditions may per-

haps manifest pain. Its causes are many but occurring in middle life the disorder is very often of toxic or of reflex origin.

Headache is a frequent symptom in fevers and in circulatory disturbances, as anemia and hyperemia; in the toxic states of uremia, diabetes, gout and rheumatism; in the intoxications of alcohol, tobacco, coffee, and lead; in the organic diseases of meningitis, encephalitis, hydrocephalus, tumors, abscess, syphilis, and diseases of the bones; as one of the symptoms of neurasthenia, psychasthenia, hysteria, epilepsy, and hypochondria; it results reflexly from disturbances of the eye, ear, nose, sinuses, teeth, throat, stomach, liver, bowel and pelvic organs; after excessive mental or physical effort, insomnia, and from hot and poorly ventilated rooms; after trauma, and sometimes arteriosclerosis beginning in the latter part of middle life gives rise to headache. One must bear in mind that more than one of these causes may be operative. Headache varies as to character so that it may be dull, sharp, boring, burning, throbbing, or there may be a sense of constriction or of pressure; also, it may be localized or diffuse.

Two varieties of headache are worthy of special mention, the first being due to a mild disorder and the other to a grave affection.

Induration Headache. Under the caption of fibrositis reference is made to this type of headache, and Edinger, who has most accurately described the disorder, says it is probably the most frequent form of headache. Meningitis has been mistaken for this condition but a more common error is to consider the attacks as those of migraine. With practice one becomes able to explore the scalp and neck where the nodules and indurations of fibrositis are readily palpable. Slight pressure over these sites elicits marked hypersensitiveness and even between the attacks slight tenderness persists, though to a lesser degree. Bad weather, a draft (in those unfortunate individuals who are susceptible to this influence), or washing the head without thoroughly drying afterward, may be the means of precipitating an attack. The headache occurs in various parts of the head, depending upon the sites of the indurations, and there may be radiation of the pain. Fever and redness are absent.

Syphilitic Headache. If soon after a luetic infection slight headache is experienced, one should be suspicious of a beginning meningeal involvement. Later, the disorder becomes somewhat characteristic by reason of exacerbations, often of a boring or a hammering nature, which may perhaps reach their maximum intensity at night or in the early morning. Syphilitic headache, while rare, is at times most intense and may be accompanied by nausea or even vomiting, in which event it should be differentiated from migraine but more especially from brain tumor. The patient is at all times prone to a dull pressure sensation. The disorder is of course attended by other of the many signs of neurosyphilis.

The *treatment* of headache is removal of the cause. Among the remedies employed in the attack are antipyrin, phenacetin, acetanolid, caffeine, cannabis indica, and the bromides. Syphilitics must receive antisyphilitic medication. Induration or rheumatic headache should be overcome through good general hygiene, active elimination and the administration of aspirin and the salicylates; however, the successful removal of these indurations is only accomplished through scientific massage.

MIGRAINE.

Migraine is a paroxysmal neurosis with headache, often of a peculiar character, as the prominent symptom, and is attended by nausea, usually increasing to retching and frequently with vomiting which, however, is independent of the taking of food. Because of its tendency to occur on one side, the disorder is frequently referred to as hemicrania. The attacks usually last a few hours, possibly much longer, and then they leave the patient feeling well. Sometimes the disorder begins in childhood, but almost invariably before thirty years, and tends to terminate in middle life. One doubts if such diseases as malaria, hysteria, nasal and ocular disorders may cause migraine but unquestionably they precipitate attacks. The headache tends to appear upon arising or shortly after, it is felt within the cranium and is accompanied by a sense of pressure and a burning behind the eyes. The special senses become hypersensitive and prostration gradually develops.

In pathogenesis, migraine appears to be a vasoconstrictor neurosis, and several types are recognized of which the best known is the ophthalmic. The experiences of a patient that I have recorded elsewhere are illustrative of this type. The subject, who was an epileptic, had her attacks of migraine about once a week. The headache was always preceded by the appearance of a bright light before one or the other eye, but never before both in the same attack; this light was shaped like the flame of a gas-jet, with a serrated upper edge and an attenuated extremity which always pointed to the outer side and which the patient referred to as the "tail." The light lasted about twenty minutes and before it disappeared the headache began and this was always preceded by double vision—ophthalmoplegia. Usually, the headache persisted for a half hour and frequently there was intense nausea and vomiting; when the attack subsided the patient felt perfectly well except for weakness. An angiospastic form—where the face is white—and an angioparalytic form—where the face is red—are encountered. Transient aphasia and transient paralysis, either motor or sensory, may be manifested and abortive forms occur.

For the prevention of attacks, all possible rules of hygiene must be observed. Fresh air, especially at night, must be provided for. Attacks are prone to develop upon an empty stomach, and other causes, which patients have learned through experience precipitate attacks, must be overcome. Constipation, eye, nose and throat conditions should all, if possible, be eradicated. In a severe attack, absolute rest is imperative.

Perhaps the most useful drug is potassium bromide, while chloral, antipyrin and caffeine afford relief to some patients. In the more distressing cases, especially with extreme retching, morphin may be used, since habituation probably never occurs where the drug is employed exclusively for the relief of migraine. The head may be tightly bandaged and local heat together with hot foot baths may give comfort. Galvanization by applying a weak current to the neck is spoken of with favor.

VERTIGO.

The accurate sense of space and the maintenance of equilibrium is manifested through the activity of the labyrinth of the internal ear, of the eye and by the sense of pressure. With the loss of one of these the individual can only maintain his balance with difficulty, and any perversion of this space sense leads to vertigo. The disturbance, which is also known as dizziness or giddiness, is almost always symptomatic, but a few cases are of unknown origin and so are classed as idiopathic vertigo. In this disorder of unsteadiness of position, the objects surrounding one appear to revolve, or the reverse may be true, but neither is distinctive of any particular lesion. Vertigo may result from disease of the vestibular apparatus of the internal ear, from irritation along the vestibular tracts or from a lesion elsewhere within the cranial cavity. Sometimes there are associated such symptoms as nystagmus, deafness, nausea, vomiting, rapid and irregular heart action, general relaxation and weakness, and perhaps profuse sweating. Usually, the attacks are sudden and of short duration. Rising quickly or placing the head in certain positions may precipitate an attack, and if standing, occasionally the individual may fall. Consciousness may be somewhat disturbed, but seldom is it lost. Depending upon its origin, several varieties of vertigo are recognized.

Aural Vertigo. This may arise from a disturbance of the external, the middle or the internal ear. It may be due to the presence of foreign bodies, the accumulation of wax, the presence of boils or to otitis media. When the disease arises within the internal ear it is spoken of as Ménière's disease, the chronic form of which may be due to gout, rheumatism, diabetes or to exposure to cold. The acute or apöplectiform variety is due to hemorrhage into the labyrinth and yields deafness, tinnitus, disordered equilibration, and perhaps vomiting and syncope. There may be several attacks with more or less permanent deafness resulting. Cerebral hemorrhage, cerebellar hemorrhage, or tumor of the cerebello-pontile angle may require some differentiation.

Vertigo of Visual Origin. This may result from refractive errors, muscle imbalance or ocular palsies.

The following are some of the more common causes of vertigo: Organic diseases of the cerebellum, its peduncles, and the cerebrum, such as tumors, abscess, syphilis or sclerosis. Sudden changes in intracranial pressure, as in straining at stool, heavy lifting, and running. Seasickness through agitation of the fluid in the semicircular canals. The toxic substances of alcohol, tea, coffee, and tobacco. Drugs like quinin, salicylates, and the coaltar products. Autointoxications and infections. Cardiovascular conditions, neurasthenia, hysteria, hypochondria, and epilepsy. Reflexly from the nose, larynx, and stomach. Psychological states, as in the fear of high places, and in some other phobias.

In disturbances of muscle sense vertigo sometimes occurs but not so frequently as does staggering.

The *diagnosis* of vertigo requires an extensive general survey with special investigations including the Bárány tests with heat and cold, and of pointing and of falling.

Treatment consists in removal of the cause, possibly through surgical intervention. During the attack, rest in bed may be required and perhaps sedation.

DISORDERS OF SLEEP.

The amount of sleep required varies with many conditions, but a fair average for middle life is about eight hours, with perhaps a trifle more for women. Brain workers need less sleep than do those who only perform physical labor. Some individuals have allowed themselves but little sleep and seemingly without injury—Napoleon and Edison about four hours—but if such statements are trustworthy, the sleep they had must have been more profound than is that of others. An absence from sleep for two weeks or even more, is said in some persons not to be incompatible with life, but certainly it is more quickly fatal than is starvation. One must not always believe the surprising statements made by some patients regarding the extent of their wakefulness.

Insomnia. By insomnia one means a period of absence from sleep, or sleep that through frequent interruptions is insufficient. The condition occurs most commonly in middle life and may result from one's inability to lay aside the mental activity of the day, from excessive fatigue, from dis-

eases—organic or functional—and from such intoxications as result from the overuse of tea, coffee, tobacco, or alcohol. Unless relieved it leads to a loss in weight, irritability, depression, and a general lowering of the physical and mental force. Prolonged lack of sleep is sometimes a forerunner of insanity or it may be a troublesome feature during the course of a psychosis and then it is apt to be attended by marked motor restlessness.

Treatment should be directed toward the cause and for this purpose a careful survey should be made of the patient's physical and mental condition, together with consideration of his temperament and habits. Matters of general hygiene are important, such as the amount and the kind of work done, exercise and amusement; the quantity and quality of food taken, particularly at night; the condition of the sleeping apartment—as to its quietness, the amount of bed-clothing, the securing of good ventilation—and a regular hour for retiring should be insisted upon.

In the matter of drugs, care must be exercised and morphin is interdicted unless the wakefulness is attended by unbearable pain. The remedies most in favor are bromides, adalin, medinal, veronal, sulfonal and trional. Then there are special indications, such as the use of paraldehyde in alcoholism, and of luminal, scopolamin and hyoscin in mental cases. When the patient is susceptible to suggestion, a placebo in the form of a capsule containing starch, may yield the desired result. Hydrotherapeutic measures are useful, such as the warm bath or in aggravated cases as the cold pack. Gentle massage is sometimes conducive to sleep. A very small quantity of food and in some persons beverages, which must not be taken in stimulating quantities, are helpful.

Excessive Drowsiness. This manifestation is occasionally observed, and the neurasthenic whose disorder has developed upon a basis of intestinal intoxication sometimes speaks of feeling "dopy"; it is also a very common accompaniment of "biliousness," and one must also be alert to the possibility of the individual being a drug addict. Drowsiness may follow a number of conditions, such as concussion of the brain, prolonged exposure to cold, after an epileptic seizure, or in

cerebral syphilis, and a number of general diseases are attended by this state. Sometimes it precedes a psychosis, and pituitary disturbances are often provocative of somnolent attacks. It may be purely a habit, as shown by some healthy individuals who fall asleep during church service. I have seen the condition simulated by pathologic lapses of consciousness due to momentary psychic attacks of epilepsy.

Treatment should be directed to the underlying cause. A few cases are benefited by small repeated doses of thyroid extract.

Dreams. Apparently dreaming is a normal phenomenon, since it probably always attends sleep, but during the first few hours sleep is so profound that such a manifestation cannot afterwards be recalled. Civilized man is more given to dreams than is his less gifted brother and the latter is prone to regard such experiences with superstitious awe. Recently, the Freudian school has given much attention to the analysis of dreams and its devotees have attached great significance thereto. According to such teaching, dreams show what they have been pleased to term the manifest content and the latent content. By the manifest content is understood the acceptance of the dream as associated with actual occurrences experienced by the individual during the few hours previous. The latent content, however, has a more serious significance and is composed of the material which the individual has crowded out of the field of full consciousness—repressed—and which he has endeavored to disbelieve. The interpretation of dreams belongs entirely to the domain of psychoanalysis, where those who are further interested should seek information.

Functional disorders such as neurasthenia, psychasthenia, hysteria and melancholia are sometimes attended by troublesome dreams; also, individuals who are temperamentally nervous and some of those suffering from chronic diseases, notably cardiac disorders, are subject to vivid and distressing dreams. When the dream-state becomes an aggravated one, the term nightmare is applied. Sleeping on one's back is conducive to the condition and in women it may be experienced during the menstrual period.

Somnolentia. Sleep drunkenness, as the condition is also called, develops in a few persons when they are suddenly wakened from deep slumber. The state has grave medico-legal significance, since while in this condition the individual may be fearful, incoherent, even maniacal and resort to acts of violence, and for which his responsibility may be questioned.

Somnambulism. The sleep-walker enacts his dream by moving automatically under the domination of a single idea. The senses are not in operation, though occasionally the eyes are open but apparently the sleeper is not guided by them. Many dangerous feats may be accomplished in this state which would not—perhaps could not—be performed if the individual were fully awake. This strange circumstance is due to the fact that the senses are not alert, therefore, the sleeper is oblivious to the actual dangers surrounding him, and this fact further shows how harm may result from suddenly awakening him if in a position of peril.

Narcolepsy. Paroxysms of sleep may rarely be encountered in hysterics, in epileptics, or in other individuals. It is characterized by attacks of complete sleep which the individual is powerless to overcome. Narcolepsy may last for a few minutes or the individual may lie in this state for hours.

Trance. This period of prolonged sleep is occasionally observed in hysteria and it may continue for a day or even for months. A similar, though a more stuporous state, is at times seen in dementia precox and in stuporous melancholia. When the disorder is attended by a waxy rigidity of the extremities—maintenance of position in which placed—the phenomenon is spoken of as catalepsy.

MULTIPLE CEREBROSPINAL SCLEROSIS.

This disease, which is characterized by intention tremor, an ataxic-spastic gait, nystagmus, and defective speech, usually begins early in middle life and it is but seldom that the first manifestations appear after this period. Heredity has but little bearing upon the disease, while infections, mineral poisons, trauma and exposure all have been held responsible

in a number of recorded cases. Multiple sclerosis is relatively infrequent in this country, though of recent years more cases have come to light, which perhaps is due to a number of irregular forms having been previously unrecognized. The irregular patches in the brain and cord—possibly limited to one or the other—are more commonly found to have developed on or near the surface. Despite the wide variation as to number, size, shape and location of these areas, the symptoms when compared in different cases are found to be fairly uniform. There are, however, often variations on the two sides of the body.

Early manifestations appear first in the motor sphere and it is here that the symptoms continue to dominate. The legs become weak and the gait which at first is spastic, later acquires a cerebellar tendency. The reflexes are exaggerated, clonus appears and the Babinski sign can often be elicited. It is rather characteristic of the disease that abdominal reflexes show some deviation, also the cremasterics. The tremor is distinctive—intention—is not manifested when the hands are at rest, nor is it confined to these parts, since the head, trunk and lower extremities may show some participation. Sensation is not to any considerable degree involved, although patches of anesthesia or hemianesthesia have been observed. Among the special senses only those associated with disturbances of vision are worthy of detail consideration. Nystagmus, which is common, may even be spontaneous; optic nerve atrophy develops and a paleness of the temporal discs is rather distinctive; then there may be intermittent amblyopia, central scotoma, retrobulbar neuritis and transient oculomotor palsies. Sometimes the V, VII, and XII nerves are implicated, the last being concerned in disturbance of speech. The speech is slow, monotonous, syllabic and soon shows fatigue, while later it may be explosive or even lost. There is sphincteral involvement which eventually progresses to incontinence. Vasomotor and trophic disturbances are occasionally present. Participation of the brain in the pathological process shows itself in vertigo, mental enfeeblement, apoplectiform and epileptiform attacks, spasmodic laughing and crying; the patient may become delirious, expansive, hallucinatory and finally demented.

Some differentiation may be necessary from cerebrospinal syphilis, progressive lenticular disease, and in the early stages possibly from hysteria. The disease is progressive in its course, though remissions may occur. An acute and rapidly fatal type has been reported but usually the patient lasts from five to ten years, and then frequently dying of some intercurrent affection such as pneumonia. Occupational therapy in the open air is advisable in the early stage and later the treatment must be symptomatic.

PARALYSIS AGITANS.

This affection, also known as Parkinson's disease, is seldom met with until late in middle life. Direct heredity is not recognized as a cause, though the ancestry may have shown a tendency to early degenerative changes in the nervous system. Possibly mental shock and probably physical shock are at times active in its production. Exposure, hard work and worry may be factors. Hypothetically, overaction of the parathyroids has been cited (Lundborg). It may perhaps be due to an arteriosclerosis of the lenticular and thalamic portions of the brain and of parts of the cerebellum, whereby a presenile degeneration is brought about.

In most instances the symptoms appear insidiously, beginning with slight muscular rigidity in the arms, head, trunk and legs; but sometimes even preceding this there have been paresthesias and fugitive and lancinating pains in the extremities. As the disease progresses an attitude is assumed which is characteristic. The patient moves slowly about with short shuffling steps, with the head and body bent forward; the arms and knees are slightly flexed, the fingers and thumbs tremulous and they have the appearance of constantly rolling some small object between them; the face is mask-like, the eyes widely open and winking but infrequently; all movements are performed slowly and stiffly. At first the muscular rigidity may not be symmetrical but gradually it extends throughout the body, is attended by but little increase of reflex activity and is without clonus or the Babinski sign. The tremor, while not invariably present, usually begins with the rigidity, but occasionally it appears subsequently. It is slow and rhythmical and occurs from

three to five times per second. Commonly beginning in one or both arms, the tremor gradually extends to the rest of the body and head. This agitation decreases when the part is in motion and ceases during sleep. It is intensified by emotional excitement and by cold. The patient's strength is fairly well preserved and his paralysis never reaches an extreme degree. The speech is hesitating and monotonous. Often the gait is singular, tending toward propulsion, lateropulsion or retropulsion. Sensory manifestations are infrequent except for some fugitive pains and feelings of heat and cold. Sometimes there are active secretory disturbances, and vasomotor manifestations may appear in the form of flushing of the face, cyanosis, tachycardia and dermatographia. The mentality is usually well preserved except for some anxiety and depression, though I have had two patients who developed a psychosis of sufficient intensity to require institutional detention.

Diagnosis of paralysis agitans is usually unattended by difficulty but certain disorders such as hysteria and multiple sclerosis may occasionally require some differentiation. The course of the disease is very slowly progressive, though abortive types may be encountered. The patient is later obliged to remain in his chair and ultimately becomes bed-fast, where he may lie for years until carried off by some intercurrent affection.

Treatment is discouraging. Hyoscin hydrobromate was formerly the drug of choice to relieve the tremor, but since a toxic action is sometimes observed, belladonna is probably preferable. Favorable results have recently been reported from the use of parathyroids, but their continued administration has resulted in muscular and cardiovascular weakness, which, however, may be prevented by reducing the dose and by the addition of a small quantity of digitalein. Sedatives in the form of bromides and the alcohol group of hypnotics are useful. Tonics should be employed, and the measures conducive to the best general hygiene must be adopted. Occupational therapy is of the utmost importance and exercise through the various forms of Zander apparatus are helpful. Hydrotherapy and diathermy are useful.

TETANUS.

This is an acute or subacute infectious disease, characterized by paroxysmal tonic spasms of the voluntary muscles, notably those of the jaw, hence the familiar term of "lock-jaw"; it is not attended by unconsciousness. The affection is most common in hot countries and the colored race show some susceptibility. Tetanus is caused by the tetanus bacillus, which may normally be found in the feces of the horse, cow and also of man, from which it finds its way into the soil. The organism is highly resistant and does not succumb to the ordinary destructive agencies. Entrance into the body is usually through wounds of the hands or feet, since it is these parts that are most exposed to injury; here the organism remains, though the reaction at the point of entry is but slight. Two toxins are recognized: tetanospasmin, which produces the convulsions, and tetanolyisin, which is destructive to the red corpuscles of the blood. The activity of the former poison is for the most part manifested upon the spinal cord, which it has reached by traveling along the course of the axis cylinders, probably of the motor nerves. The period of incubation varies from a few days to perhaps three weeks. Usually, the first symptom is a slight stiffness or spasm of the muscles in the neck or face; if the latter, the characteristic risus sardonicus is produced; soon the muscles of mastication become tonic, and trismus or lock-jaw results. The body muscles become involved and with a paroxysm the positions of opisthotonos, pleurothotonos, orthotonos or emprosthotonos may be assumed. Profound exhaustion ensues. The spasms extend to the muscles of respiration and of the larynx, interfering with breathing and endangering life. The slightest peripheral stimulation is sufficient to precipitate a paroxysm. Seldom is there a rise of temperature until death approaches. Where the point of entrance has been about the head or face, cephalic tetanus may result.

Some differentiation is at times required from strychnin poisoning, hysteria, epilepsy, and hydrophobia. If the disease becomes fully developed, death usually results in three or four days, though the modern treatment with antitoxin has lessened the number of fatalities.

Treatment consists of immediate surgical attention to the wound; prophylactic doses of antitoxin should then be administered, and these must be followed by larger doses if the disease progresses; intravenous and hypodermic injections of magnesium sulphate solution find favor with some, and chloroform and sedatives are indicated. On account of the high tension of the cerebrospinal fluid, frequent lumbar punctures are often necessary. Rectal feeding must be resorted to in the more grave cases.

RABIES.

This disease, while not confined to middle life, is considered here, because hysteria, which is commonly met with at this period, has frequently been mistaken for rabies in those who believed themselves exposed to this infection. Furthermore, the "mad-dog" scare causes an almost annual alarm in many communities. Rabies, formerly known as hydrophobia, is an acute infectious disease caused by the *neurorhynchus hydrophobiæ*, which are also called the bodies of Negri, since it was he who first described them. At necropsy lesions have been found in the cerebrum and its associated ganglia and in the ganglia of the sympathetic system. To man the disease is usually transmitted by dogs, though not necessarily so, since cats, cattle and wolves may also convey the infection. The bite of a rabid animal may not be followed by rabies, particularly if the individual has been bitten through the clothing, and less than half of those actually wounded develop rabies. The period of incubation varies widely from a few days to several months, and it is said may be for more than a year.

The first symptoms are usually pain and redness at the site of the wound, and these are followed by the mental manifestations of depression, irritability, restlessness, sleeplessness and headache, which symptoms constitute the prodromal stage. Soon the period of excitement develops, beginning with great hyperesthesia, so that the slightest peripheral irritation may bring on pronounced spasms; the muscles of the pharynx, larynx and those of respiration become involved; attempts at swallowing, even of water, cause intense spasms of the larynx and this has led to the unsatisfactory name

of hydrophobia. Maniacal excitement often develops to the extent that restraint is necessary. The spasms are not continuous and the patient may be rational at intervals; the temperature is usually elevated. After two or three days the excitement subsides and the paralytic stage ensues; here the patient becomes unconscious, which condition progresses into deep coma, with death usually resulting in a few hours. Sometimes the symptoms partake of those of Landry's paralysis.

The only disease requiring differentiation is hysteria and formerly it sometimes happened that one who had been bitten by a dog, not rabid, would get into an emotional state and simulate the manifestations of rabies. After the disease has developed, it is usually rapidly fatal. Animals suspected of having had rabies should be allowed to live for the purpose of observation; and even after death the hypocampal and cerebellar cells should be examined, where, in the event of rabies, the organism can usually be demonstrated; with negative findings, this effort should help to relieve the apprehension of any one who may have been bitten.

Treatment consists of at once applying nitric acid or actual cautery to the wound, then if possible place the patient in a Pasteur institute where an attenuated virus is used for the purpose of immunization, or, if the disease has developed, as a means of cure. Occasionally, the peculiar condition known as "treatment paralysis" results from use of the attenuated virus.

SUNSTROKE.

Heat stroke, heat exhaustion, thermic fever, insolation, and siriasis, are all terms used in this connection. The common forms of disturbance are thermic fever or sunstroke, heat exhaustion and heat cramps.

Thermic fever occurs most frequently in men who are exposed to the sun in a hot, humid atmosphere. Roofers, hod-carriers, brick-layers, masons, farmers and soldiers are those most frequently affected. It also occurs among the workers in a closely confined atmosphere, as in boiler rooms, laundries, glass factories and kitchens. Such workers who are heavily clad and who use alcohol are particularly liable

to the disorder. As one would expect, the colored race shows considerable immunity. Exposure out of doors between the hours from 2 to 5 P.M. shows the most victims. The intense heat leads to extensive engorgement of the brain, cord and meninges; also, the lungs and spleen; the liver and kidneys show parenchymatous changes.

One form, the asphyxial, while not common, may prove rapidly fatal and sometimes, as if by a blow upon the head, with just a few convulsive movements, death will occur almost instantaneously. In such cases the symptoms are coma with cardiac and respiratory failure. More frequently, however, there are observed vertigo, headache, nausea and vomiting, colored vision, dryness of the skin, dyspnea, diarrhea, and frequent micturition. Often the patient becomes delirious and this frequently deepens into coma. The pulse is full and rapid, and the pupils are contracted. Petechiæ sometimes appear. The temperature may be subnormal, but usually it ranges from 102° to 106° F. In fatal cases there may be convulsions, the coma deepens, there is muscular relaxation, the heart action weakens, and the breathing becomes shallow. Death may occur in from twenty-four to forty-eight hours. Many recover, though not always completely, since a few may ever afterward find any considerable degree of heat insufferable, and others sometimes show such after-effects as failure of memory and inability to properly concentrate.

In the hyperpyrexial form the early symptoms are progressive weakness, nervousness, irritability, dizziness, headache and cramps. The state of automatism is occasionally seen. The skin becomes dry, red and hot, though rarely it is clammy. The temperature mounts to above 106°, with a corresponding rise in pulse rate. The patient becomes delirious, confused, and finally comatose. The sphincters may be incontinent. When the symptoms are less severe, there may be a gradual abatement, but in others the temperature may rise to from 110° to 115° F. with death soon resulting.

Heat Prostration. With this there may be associated some of the symptoms of heat stroke. The symptoms of prostration are weakness, vertigo, headache, nausea, numbness, and

tingling. Later, cardiac and respiratory weakness appear, together with the other symptoms of collapse. The temperature is usually subnormal though occasionally a slight elevation may be observed.

Heat Cramps. This condition was described by Edsall, who observed that laborers working hard in high temperatures, such as stokers, workers in boiler rooms and about furnaces, were occasionally seized with painful spasms. He believed the condition to be due to an acute degenerative process in the muscles involved. The musculature of the forearms, legs and abdomen was chiefly implicated, and the spasms developed spontaneously, though they could be elicited by physical or electrical stimulation. Fibrillary contractions were sometimes seen. The pain (which was intense) was followed by soreness and exhaustion. The attacks lasted from ten to thirty hours.

Treatment. When the temperature is high, it must be reduced by rubbing with ice or it may be employed in the form of a bath, a pack or an enema. A subnormal temperature must be combated with warm baths or with hot-water bottles. In exhaustion, cardiac and respiratory support must be given. For the convulsions, morphin or chloroform may be necessary. Careful feeding must be instituted. Subsequent exposure to any considerable degree of heat should be avoided and possibly a change of climate may be necessary.

DISEASES OF THE PERIPHERAL NERVES.

THE NEURALGIAS.

Neuralgia is a symptomatic, paroxysmal pain, limited to the anatomical distribution of a sensory nerve. The disorder is most pronounced in middle life, women are the more frequently affected and often an hereditary influence is shown. Many conditions underlie these intermittent or remittent pains, such as diseases causing general debility, functional neuroses, strong emotion, excessive hemorrhage, refrigeration and trauma; malaria, tabes and other common affections, the intoxications and early arteriosclerosis. In character the pain is variously described as tearing, burning, darting, piercing, and stabbing. Often the affected nerve

is sensitive to moderate pressure, frequently it will be found much more so than the corresponding nerve upon the opposite side. At certain sites particularly painful sensations may be elicited and these are known as the painful points of Valleix. The blood pressure usually shows hypertension. Sometimes there are associated the vasomotor manifestations of pallor, flushing and increased pulsation; secretory disturbances of increased sweating, salivation, edema, and large quantities of urine may be passed; trophic disturbances of blanching of the hair, of its increase or loss, pigmentation, cutaneous eruptions of various kinds and of hypertrophy or atrophy of a part, also, trophic changes in muscles, bones, and joints. Some differentiation may be necessary from inflammatory conditions in the joints, periosteum, and bones. Ultimately, some of these patients with the severer grades of neuralgia, through inability to bear their suffering, in a minor sense become antisocial. They grow irritable, moody and morose; they may not be able to work among others and so lead more or less solitary lives.

The more common types of neuralgia are those of the trifacial nerve, the cervico-occipital region, brachial neuralgia, intercostal neuralgia, mammary neuralgia, coccygodynia, crural neuralgia, testicular, ovarian, and traumatic neuralgia.

Trifacial Neuralgia. When neuralgia of the fifth nerve reaches its maximum intensity it is known as "tic douloureux." This nerve is most frequently the seat of neuralgia and the affection is largely one of middle life, with the female sex predominating. An hereditary influence is sometimes observed and winter, by reason of its effects consequent upon refrigeration, is the season most to be dreaded. The milder type of the disorder is generally symptomatic and the involvement is usually of the supraorbital branch, but either of the other two, or all of the branches may be implicated; the affection is mostly unilateral. Rheumatic disturbances may cause attacks, and nose, throat and dental affections are frequent causes; other factors are debilitating diseases, syphilis, malaria, epilepsy, hysteria, and trauma. Often there is extreme tenderness to pressure in the branches of the nerves as they emerge from their foramina upon the face. The pains come and go but they may last for several days; if

very intense there is dilatation of the pupil and possibly reflex facial spasm.

The more severe form—*tic douloureux*—usually appears later in life than the preceding variety and is characterized by the most agonizing pain; almost invariably it is unilateral. One or more branches of the nerve may be affected but the ophthalmic division is most frequently the seat of this pain. The affection may result from debilitating disorders, local conditions, arteriosclerosis of the Gasserian ganglion, or it may be symptomatic of such grave disturbances as growths at the cerebello-pontile angle. Attacks sometimes appear spontaneously, by the taking of cold water or even from an attempt to talk. Most commonly the pain starts in the upper lip, and then with agonizing intensity it darts up to the brow or into the lower jaw, and sometimes into the tongue, roof of the mouth or into the ear. The agony may last but momentarily or the patient may be held in its throes for hours. The suffering produced has been compared to the feeling which would be caused by drawing a red-hot wire through the face, and occasionally—in desperation—the patient will attempt suicide. When the paroxysm is at its height, vasomotor and secretory manifestations are common; tears pour down the face and nasal and lachrymal secretions are poured out. During a series of attacks herpes may develop and ultimately such trophic changes as blanching of the hair and even hemiatrophy of the face may occur. The special senses sometimes show manifestations and mental confusion may result. Convulsive movements of the facial muscles are common and even the upper extremities may become spasmodic. Attacks are likely to appear in series and may extend over years, while, on the other hand, some patients have only a few attacks during a whole lifetime. A few cases terminate spontaneously. The disorder, though severe, does not appear to be in conflict with longevity.

Cushing speaks of five types of facial neuralgia which may be mistaken for trigeminal neuralgia: those ascribed to the sphenopalatine ganglion, to the geniculate ganglion, those secondary to zoster, those accompanying cases of convulsive tic, and those due to trigeminus involvement by tumors; all

of which, if possible, should be excluded before neurectomy is performed.

Treatment should be directed to the cause and with this in view one should make a critical survey of all parts of the head and its associated cavities and sinuses; general diseases must be considered. Such drugs as the coal-tar products, allonal, bromids, nitroglycerin, aconite, gelsemium, strychnin, quinin, iodids, and preparations of iron, may be useful. Local applications should be tried and local heat often affords relief. Injection of alcohol into the branches of the nerve sometimes stops the pain for long periods, and injection of alcohol beneath the sheath of the Gasserian ganglion has been done, though the procedure is a dangerous one; x-ray treatments are reported to have been of benefit. Formerly, neurotomy of the nerve branches was employed and sometimes even the radical procedure of removal of the ganglion was resorted to. Recently, the less objectionable operation of cutting the sensory root posterior to the ganglion has gained in favor, since in skillful hands the operation is safe and the relief afforded is permanent. Narcotic drugs should be withheld as long as possible, for the intense suffering makes easy the establishment of drug addiction.

Cervico-occipital Neuralgia. This occurs in the distribution of the first four cervical nerves, especially in the great occipital nerves. The disorder results from trauma, strain, diseases of the cervical vertebræ such as tuberculosis, syphilis or rheumatoid arthritis; from tumors or pachymeningitis; from an aneurism or enlarged lymphatics; and emotional disturbances or excessive mental strain may also cause such pain. Often the neuralgia is bilateral, the head is stiffly held, the scalp and skin are hypersensitive, and deep pressure will cause the patient to wince. In extreme cases, trophic disturbances in the form of thinning and graying of the hair are sometimes encountered. The disorder is sometimes associated with the following variety.

Brachial Neuralgia. The lower four cervical nerves are here implicated and the affection is rather more common in women, with an occupation neurosis frequently as the precise condition. It may result from trauma, diseases of the vertebræ, tumors or aneurisms; from diseases of the cord and its

membranes; it occurs in angina pectoris; or the cause might be a cervical rib, the presence of which would be revealed by an x-ray study. The pain is likely to be shooting, the skin is tender, and the reflexes of the extremity are increased; there may be painful points upon pressure at the axilla, elbow or wrist; sometimes there are secretory and vasomotor phenomena, and trophic changes may ensue; zoster may be present and a burning pain—causalgia—following puncture wounds of the arm or forearm, is occasionally observed.

Some differentiation is desirable. When the pain has its origin in diseases of the spine, cord or membrane, the disorder may be bilateral and local signs in the extremities would for the most part be wanting. A possible poisoning from alcohol, lead and diabetes, should be borne in mind, and special consideration must be given to the pains of neurasthenia and hysteria.

Treatment consists in removal of the cause, if possible, otherwise, rest for the part, massage, electricity, hydrotherapy, psychotherapy, eliminants and analgesics, with possible cutting of the posterior nerve roots in extremely intractable cases.

Intercostal Neuralgia. This disorder results from involvement of some of the twelve thoracic nerves, usually from the fifth to the ninth. A stabbing or tearing pain is felt along one or more of the ribs, and tender points may be elicited at the intervertebral spaces, around the chest, or at the sterno-costal junctions. The suffering is intensified by movements of the chest and even pressure from the clothing may be unbearable. Trophic changes are sometimes observed and herpes zoster, which is separately considered, is a not uncommon manifestation. The neuralgia may result from grave spine and cord conditions, and some differentiation is necessary from local fibrositis and intrathoracic disorders. The affection is rather stubborn.

A sub-type is mammary neuralgia or mastodynia. This is uncommon and almost invariably occurs among women. When seen it is usually late in pregnancy, late in lactation, or at the menstrual period. The neuralgia experienced is deep seated and there is sometimes an increase of secretion.

If in addition to extreme tenderness, a local induration is present, one might be suspicious of a growth. Local applications and support are indicated. Much relief has been afforded by firmly but slowly elevating the entire breast for a period of about twenty seconds, which slowly stretches the nerve; this should be repeated several times a day.

For the *treatment* of intercostal neuralgia support is often necessary. Blistering and cautery have been used, and spraying with ethyl chloride often gives great relief. Local remedies and anodynes are usually necessary and reconstructive tonics may be indicated.

Coccygodynia. This is a term applied to neuralgia occurring at the tip of the spine and is more common in women, especially primiparæ. Obstinate constipation, trauma, and local diseases are factors in different patients, and sometimes it develops in the functional neuroses. Defecation is likely to be especially painful and the patient may not be able to sit. The disorder is a not uncommon feature of litigation cases. Management of such a patient is difficult and an operative procedure should not be resorted to unless absolutely necessary.

Crural Neuralgia. Pain in the course of the anterior crural nerve is more common in men, since exposure, injuries and excessive physical effort—such as long marching—may bring it about. The disorder is sometimes secondary to diabetes, vertebral caries, and it may be associated with sciatica. The condition may also result from pressure at the bottom of a corset. Painful points are sometimes found in the groin, down the front of the thigh, and at the inner side of the knee and ankle. Sometimes there results slight trophic changes. Intrapelvic conditions as a cause should be eliminated.

Testicular Neuralgia. This condition is at times a very painful one, so much so, that the patient may ask for the removal of his testicle. The disorder is usually unilateral and the organ may be slightly swollen, tender and drawn tightly upward, with excruciating pain extending into the leg or back, and sometimes sufficiently intense to induce vomiting. Refrigeration may provoke an attack or it may be secondary to a local disease. Men who are hyperactive

sexually sometimes suffer from such pain, and then it is likely to be associated with pain in the groins.

Traumatic Neuralgia. Trauma to the nerves occurs in many different forms, as from contusions, falls, or blows, incised or punctured wounds, in fractures and dislocations, in diseases of the bones and periosteum, and in the development of neoplasms. Following such injuries, neuralgic pains may appear. Sometimes after amputations, neuromata are found to have developed at the cut ends of nerves, and these give rise to intense paroxysms of pain. Mitchell observed a condition which he designated "causalgia" but for which the term "thermalgia" has been suggested, since an intense burning pain is its characteristic symptom. This condition most commonly follows gunshot wounds which give partial division of the nerves, resulting in an excessive scar tissue formation—a secondary intraneural fibrosis. Injuries to the median and sciatic nerves are particularly liable to be followed by this disorder. The condition is believed to be of vasomotor origin.

Treatment is surgical, but in the meantime some relief may be obtained by elevation and the application of an evaporating lotion.

THE PARALYSES.

Paralysis of the Facial Nerve. This is the most frequent form of peripheral nerve paralysis, and when due to disease of the nerve trunk is commonly known as Bell's palsy. The disorder is most usually encountered in early middle life and is more common in the male sex. It may result from trauma, syphilis, and middle ear disease, but the preponderant cause is refrigeration. The onset is usually abrupt and is often preceded for a day or two by pain about the ear or in the neck. Minor variations are observed, depending upon the portion of the nerve trunk involved, but changes in the sense of taste speak for a lesion posterior to the stylo-mastoid foramen. Mild attacks may not amount to more than a paresis of the muscles, and even then the branches may not be evenly affected, but in a complete paralysis the lines of the face are obliterated, the cheek has dropped and in some instances has become edematous; the forehead



Fig. 2.—Author's device for support in facial paralysis.
(Archives of Neurology and Psychiatry, Dec., 1920.)

cannot be wrinkled, the lips closed, nor the mouth puckered; the angle of the mouth not only cannot be retracted but is actually drawn to the opposite side, especially when the unopposed muscles of the sound side are in action; tears often overrun the paralyzed cheek, and food in mastication collects on the disabled side. In looking upward, the eye on the paralyzed side rotates to a higher plane than does its fellow.

The disease lasts a variable time, usually terminating in from three weeks to eighteen months. The longer it persists, the less is the hope of complete recovery. The electrical reactions are not a safe guide as to the extent of recovery that one may expect, since reactions of degeneration have been reported as having persisted for three years and yet a complete recovery was made. The curious phenomenon termed "contracture" is not infrequent in a mild form, but the disability is much less than when a complete, permanent paralysis remains; such a contracture by reason of the contracted and wrinkled appearance which it induces, would at first lead one to believe that the sound side is the seat of a paralysis. Some differentiation may be necessary. A central paralysis almost invariably leaves the patient with the power of closing the eye, of wrinkling the forehead, and the electrical reactions are normal. In looking upward, the eye on the paralyzed side does not rotate to a higher plane as it does in the peripheral type of facial paralysis. A cortical lesion of the left side may yield aphasia in a right-handed individual. There may be weakness of the arm and the leg on the same side as the face, but on the side opposite to the lesion. A pontine lesion above the nucleus would give the same symptoms, perhaps with some sensory loss, conjugate deviation of the eyes and ocular paresis. In the part of the pons affecting the nucleus, the face will be paralyzed on the same side as the lesion, since the fibers have crossed, with arm and leg paralysis on the opposite side. There will be muscular atrophy and reactions of degeneration in the facial distribution. Moreover, nuclear paralysis is usually bilateral and is accompanied by other symptoms.

Treatment. I am convinced from experience with an adhesive device that I am using, that in all cases of complete

paralysis, immediate support should be given to the face, since in this way the course of the disease may be shortened and some of the permanent deformities and disabilities may be prevented. This device should be worn until the muscles regain most of their tone. Men, from shaving, sometimes find that adhesive plaster strips loosen, and in hot weather also, the device may slip a trifle. To overcome this objection, I have recently been making the support of a new material, distributed under the trade name of "Tirro." This substance possesses the property of adhering tenaciously and its rubber content renders it impervious to water. In those who are fastidious, the device may be tinted flesh-color. My experience with this new adhesive material is now quite large, and, so far, no dermatitis has been observed to result from its use.

I am opposed to blistering about the ear, which necessarily leads to some congestion, and which, when applied for other causes, has been known to produce a Bell's palsy. Gentle massage and weak galvanism may be used early but they must be judiciously employed. Either, if used too vigorously, may lead to contracture. Diathermia is useful and ideomotor stimulation must be persisted in. The drugs to be given are salicylates, strychnin and the iodides. In the unfortunate event of a complete permanent paralysis, the surgical procedure of anastomosis, either with the spinal accessory or with the hypoglossal nerves, has been done with some measure of success. With the development of a contracture, judicious massage and stretching may cause the muscles to lose some of their rigidity.

Musculospiral Paralysis. Paralysis of this nerve is more frequent than that of any other arising from the brachial plexus, and by reason of its exposure as it courses around the humerus, injury may result in a variety of ways. In the act of throwing, the forcible contraction of the triceps may lead to paralysis. Bone fragments from fracture in the middle third of the humerus and sometimes callous formation have pinched the nerve. Pressure in the axilla from a crutch and constricting bands about the middle of the arms as in forcible restraint; and prolonged pressure in sleep, in drunkenness and during anesthesia, occasionally cause par-

alysis of this nerve. The higher up the paralysis, the more extensive the symptoms. The muscles usually affected are the supinators, the extensors of the hand, the extensor communis digitorum, extensor indicis, the extensor minimi digiti and extensors of the thumb. Inability to extend the hand at the wrist—wrist-drop—is the characteristic symptom. Pain is not complained of but there may be some numbness and tingling on the back of the hand and at the base of the thumb and index finger. For the most part, recovery is made in from three to five months. In treatment, the wrist-drop should always receive mechanical support.

Median Nerve Paralysis. It is unusual for the median nerve to be paralyzed alone except as a result of trauma. More often it is a part of a brachial plexus palsy. Paralysis of this nerve in the axilla is more frequent than is that of the musculospiral nerve. Sprains, dislocations and fractures about the wrist may injure the nerve. Penetrating wounds in any part of the arm may cause paralysis and pressure at the elbow is sometimes responsible for the condition. Paralysis of the upper portion yields inability to pronate the forearm or to flex the wrist properly. The fingers cannot be firmly flexed nor the hand satisfactorily used. The thumb cannot be abducted nor used properly to pick up small objects.

An injury at the wrist will limit the paralysis to the fingers. There is some pain in the hand and anesthesia of the radial palm, thumb, index, middle and part of the ring fingers. Atrophy appears in the thenar eminence and trophic changes in the skin and the nails. Volkmann's ischemic contracture paralysis, which sometimes results from faulty application of a splint to the forearm, may be differentiated through implication of the flexor muscles, absence of sensory changes and the presence of feeble but otherwise normal electrical reactions.

Ulnar Nerve Paralysis. This form of palsy yields sensory changes in the forearm and hand, and atrophy in the hand. The nerve may be injured at the elbow by direct trauma, fracture or dislocation, by penetrating wounds at the wrist, and in war injury may be inflicted upon it throughout its course. When the ulnar nerve is injured above the elbow,

it is usually found to be part of a brachial plexus palsy. Refrigeration is sometimes a cause of ulnar neuritis. Symptoms vary according to the site of injury. When above the elbow, flexion at the wrist is almost wanting; abduction and adduction of the fingers, and movement of the little finger is impossible; the proximal phalanges of the fingers cannot be flexed and the last joint of the middle and ring fingers cannot be moved. Paralysis lower down yields atrophy of the interossei and thumb muscles, with the final production of the "clawed" hand. The best test for ulnar paralysis is to have the patient grasp between the thumb and forefinger a sheet of paper, when it will be observed that the paper is but loosely held and that only the end of the thumb is in contact with the paper. There is complete sensory paralysis in the little finger, and partial loss in the ring finger and ulnar portion of the hand. Trophic changes are at times observed.

Some differentiation may be necessary from involvement of the eighth cervical and first thoracic nerves, in which instance there will be attending eye symptoms. Pressure from a cervical rib may cause similar symptoms but this anomaly is easily demonstrated through an x-ray study.

External Popliteal Nerve Paralysis. Here is found paralysis of the peronei, of the extensors of the foot and long extensors of the toes, with a resulting foot-drop and toe-drop which gives the characteristic steppage gait. When sitting the patient is unable to elevate his toes or foot, nor can the foot be rotated at the ankle. Some disturbance of sensation may be met with on the outer side of the leg and upon the dorsum of the foot.

Internal Popliteal Nerve Paralysis. The foot and toes cannot be flexed, the toes cannot be abducted nor adducted, and rotation can only be but feebly performed. It is impossible for the individual to rise upon his toes. There is sensory involvement of the heel, plantar surface, outer side of dorsum and ends of toes. Slight trophic changes sometimes occur, and the plantar and Achilles reflexes are lost.

Sciatic Trunk Paralysis. Here will be found more or less of a combination of the two preceding symptom complexes.

NEURITIS AND MULTIPLE NEURITIS.

Lesions of the peripheral nerves vary greatly in their manifestations as to whether the nerves implicated are motor, sensory, mixed or those of the special senses. When several nerves are simultaneously involved the disease is spoken of as multiple neuritis. An important group showing extensive paralyses will be considered separately under paralyses of the peripheral nerves. The implication of a single nerve may result from such causes as trauma, refrigeration, compression from growths, extension of local inflammation, and from poisons or infections.

Sciatica. The term sciatica is employed in a very broad sense and so is sometimes misapplied, since too many diffuse pains in the lower extremities are thus labeled. Such a designation should at least be restricted to those disorders caused by neuritis, perineuritis or by a neuralgia of the nerve. The affection is distinctly more common in middle life, particularly in the latter period, with males contributing the larger number of cases. Those prone to gouty and rheumatic disturbances, especially when in addition they are subjected to exposure and physical strain, are among its most common victims. Frequently there is extension of the disorder from lumbago. Pressure from occupation and constipation are sometimes exciting causes, and lesions of the hip-joint, pelvis and spine may give rise to sciatic pains. In elderly primiparæ, where labor is apt to be prolonged and the use of forceps resorted to, the sciatic nerve may be injured. Certain chronic diseases such as diabetes, syphilis and phthisis, may be attended by sciatic neuralgia. More attacks of sciatica develop in fall and winter.

In onset the disorder is usually abrupt, with pain and tenderness, which may be either localized or which may extend down the back of the extremity. In severe cases there are usually paroxysms of pain which sometimes become aggravated at night; there may be a dull ache and in other instances pain which is burning, stabbing or tearing in character; that appearing at the proximal portion of the extremity is likely to feel deep seated while distal pain is felt more superficially, and below the knee is usually in the

external popliteal distribution; the discomfort is much influenced by posture; pressure may elicit pain in the gluteal region, near the sciatic notch and down the back of the extremity, but the impossibility must be borne in mind of pressing directly upon the sciatic nerve in the thigh, since muscular tissue intervenes and soreness here may be misinterpreted as sciatic tenderness. Cutaneous sensibility often shows hyperesthesia of the sciatic area and possibly some anesthesia in very protracted cases; numbness, tingling, and a feeling of cold is often experienced. Pain-spasms sometimes occur; the knee-jerk may be exaggerated early but later is likely to be diminished, while the Achilles-jerk in severe cases is usually lost. If the disease is long-continued the muscles of the buttock and even of the thigh sometimes show atrophy; contracture may ensue, and a scoliosis be induced. The phenomenon of Lasègue is quite distinctive—inability to properly flex upon the pelvis, the extended leg, because of the pain produced in the back of the thigh. Trophic disturbances, such as herpes and edema, may appear.

Some differentiation of the various types is necessary and x-ray studies of the hip-joint, pelvis and spine may be desirable. Of recent years, sacro-iliac strains have received much consideration, perhaps more than is justified. In double sciatica, growths or diseases within the pelvis or spine must be considered, and diabetes and syphilis should be eliminated. Sciatica dependent upon a well developed sciatic neuritis should not be difficult of recognition.

The course of this disease is variable, with mild cases recovering in a few weeks, while severe ones may last many months and relapses are not infrequent. The affection at times is exceedingly painful. Of recent years less has been heard of sciatica, which, however, is not due to a greater infrequency of pain in the extremities but rather to greater accuracy in diagnosis.

In *treatment* the cause must be sought. Rest in bed, and perhaps fixation, is imperative in all severe cases. The measures employed are many—hydrotherapy, electricity, massage, diathermia, stretching (very judiciously applied), blistering, and injections of normal saline solution; the employment of such drugs as salicylates, aspirin, bromides,

iodides, atropin, and nitroglycerin, but the more powerful anodynes only if absolutely necessary.

Multiple Neuritis. Occasionally, multiple neuritis occurs before middle life but seldom after. Rarely, it has appeared as an epidemic and a recurrent type has been reported. The inflammation is parenchymatous and may be due to many causes which can be grouped as: (1) exogenous poisons, such as alcohol, lead, arsenic, mercury, carbonmonoxide, copper, silver, phosphorus, potassium cyanide, and aniline products; (2) toxins from the infections of diphtheria, influenza, typhoid, pneumonia, gonorrhea, small-pox, scarlet fever, septicemia, malaria, cholera, tuberculosis, syphilis, beriberi, leprosy, and the puerperium; (3) intoxications from certain diseases, as gout, rheumatism, cancer, and blood diseases. The neuritis is symmetrical, with the extremities more commonly affected, and with the involvement more pronounced at the distal ends, from whence it extends toward the trunk. Occasionally, the disorder develops acutely with a chill, fever and headache, but more frequently the onset is gradual with symptoms appearing first in the sensory sphere. First there is numbness, tingling and pain in the hands and feet, with the gradual appearance of weakness which is soon followed by a loss of power; the pain may be intense and burning or tearing in character; often there is hyperesthesia with areas of hypesthesia and such manifestations are frequently glove-like in their distribution; sensory symptoms are sometimes attended by ataxia. The motor manifestations begin with weakness and tremor which may advance to a complete paralysis; the paralyzed muscles become flabby, undergo atrophy and the tendon reflexes are diminished or lost; the electrical reactions may become those of degeneration. Certain nerves are particularly prone to involvement—the external popliteal leading to foot-drop with its characteristic “steppage” gait, and the musculospiral causing wrist-drop; to the latter may be added a median nerve palsy which gives rise to the deformity of claw-hand.

Depending upon their etiology certain varieties are worthy of special mention: *Alcoholic neuritis* usually appears in steady drinkers and women are the more likely to develop the disorder. The lower extremities usually bear the brunt

of the attack; cutaneous hyperesthesia is present and in addition spontaneous pains appear together with hypersensitiveness upon pressure over the nerve trunks and in the muscles themselves; the tendon reflexes are diminished, atrophy—perhaps with contractures—results, and trophic changes may appear. The motor cranial nerves are sometimes implicated, and optic neuritis is now and then a manifestation. Mental symptoms, which are not infrequently associated, may be of the Korsakow type, but all of these forms are considered elsewhere. Recovery from the neuritis is rather rapid after withdrawal of alcohol, but return to drink soon leads to a relapse. Since the prohibition law has been effective, wood alcohol poisoning is more frequent, when in addition to multiple neuritis, blindness and death may result, even if but a small quantity of the poison has been ingested.

Lead poisoning results from continued exposure, and in the production of a neuritis is particularly selective in its action, as shown by the frequent involvement of the posterior interosseous branch of the musculospiral nerve; the patient develops 'wrist-drop, muscular atrophy, and shows lost reflexes; pain and tenderness are usually not a feature of this form of neuritis; rarely, the legs are affected and a shoulder-arm type of paralysis has been recorded; ocular palsies and an optic neuritis sometimes result, while a lead encephalopathy is a possibility.

Arsenical neuritis in its manifestations approaches that of alcoholic neuritis; there is pain, tenderness and paralysis, and sometimes skin lesions develop. One must bear in mind that arsenical poisoning has resulted from the injudicious use of arsphenamin, and also that it has developed in those syphilitics who were unduly sensitive to the drug.

Diphtheritic neuritis usually appears some weeks after subsidence of the active symptoms and is largely confined to the cranial nerves; the soft palate and the pharyngeal muscles are first implicated and the voice has a decided nasal twang; later, possibly oculomotor paralysis and even facial paralysis may ensue; sometimes paralysis in the extremities, with their consequent manifestations, are seen, and a

rare but most serious involvement is that of the pneumogastric nerves.

Pregnancy, especially if attended by excessive vomiting, may show a polyneuritis which in some instances is due to cachexia. In grave cases the neuritis may be of the ascending type of Landry.

The course of multiple neuritis varies with its cause but often it runs for weeks and months, and with the best of care, contractures and paralyses may be unavoidable. Fatal cases are usually those with cardiac and respiratory involvement.

Treatment varies somewhat, depending upon the etiological factor. In the withdrawal of alcohol the patient must be actively supported, and in lead palsy elimination is of the greatest importance. Rest in bed should usually be enforced and support with mechanical appliances must be given to the paralyzed parts. Pain can be relieved by the use of coal-tar products, bromides, salicylates, and possibly with chloral, but morphin and cocain should only be resorted to in extreme cases. Strychnin, iron and the iodides are often indicated. Later, massage, exercise, hydrotherapy and electricity are helpful.

HERPES ZOSTER.

This disorder is also called acute posterior poliomyelitis and is familiarly known as "shingles." It is due to a neuritis and ganglionitis of the sensory system, and is characterized by neuralgic pains and a herpetic eruption. The affection is not limited to the thoracic distribution, since there is sometimes cervical, lumbar and sacral implication, and occasionally involvement of the Gasserian and geniculate ganglia attached to sensory cranial nerves. The disorder may result from diseases of the vertebræ and meninges, tabes, and from acute infections or intoxications. The first manifestation is shooting neuralgic pains in the fibers implicated, and this is soon followed by the development of tenderness and redness over the course of the nerves where the herpes shortly appear. The affection is at times preceded by such general symptoms as fever, headache and gastrointestinal disturbance. Rarely, the disorder is so severe as to lead to extensive ulceration and even gangrene, but in

mild cases, it usually subsides in a few days. However, neuralgic pains are sometimes experienced for a few weeks after the skin lesions have disappeared. A severe type is ophthalmic zoster; this is not apt to occur except late in middle life and then usually in individuals with an alcoholic history. Here, in association with the intense pain an erysipelatous condition may develop, together with the grave ocular manifestations.

Treatment consists in the application of local remedies and internally in the administration of salicylates and bromides. If gangrene develops, or if grave ocular complications appear, special treatment must be adopted.

CERVICAL RIB.

The symptoms caused by this anomaly do not usually appear before adult life, and though manifestations from such a condition are rare, they have been recorded as occurring bilaterally, and likewise have been known to be due to pressure from the first rib. Pressure, which is most likely to be exerted upon the lower trunk of the brachial plexes, is not necessarily confined to this portion. There is usually experienced pain and an aching sensation along the ulnar side of the hand and forearm, together with the insidious development of atrophy in the muscles of the hand. Slight sensory changes may be present. Church has observed that weights borne upon the shoulder or carried in the hand may produce these symptoms, and adds that sometimes there is an interruption of the pulse in downward or upward extension of the member. Palpation may not reveal the presence of the rib so that in all cases of brachial neuralgia and atrophy of doubtful origin, x-ray studies should be made. The offending rib together with its periosteum should be removed with care, since the operation is not devoid of danger.

DISEASES WITH PRONOUNCED MUSCULAR MANIFESTATIONS.

PROGRESSIVE MUSCULAR ATROPHY.

Various types of this disorder are met with and sometimes they occur in mixed form. The affection results from vascu-

lar changes and a slow disappearance of the anterior horn cells with consequent atrophy of the corresponding muscles and sometimes with involvement of the pyramidal and anterolateral tracts of the cord. Upon an inherently weak nervous system, trauma, exposure, over-exertion, infections, and intoxicants, may act so as to bring about the various forms of this disease. A type known as that of Aran-Duchenne is distinctly of spinal origin and appears insidiously through inability to perfectly adduct the thumb of one hand, which is soon followed by imperfect separation of the forefinger from the middle finger; later, the patient notices that skilled movements of the fingers and hand can no longer be properly executed and atrophy sets in, noticeably that of the thenar and hypothenar eminences; soon the other hand becomes involved and both assume a claw-like appearance; the shoulder girdle, forearm and back are implicated, fibrillary tremors are seen, the tendon reflexes diminish, and electrical changes appear which ultimately amount to reactions of degeneration. Bulbar symptoms sometimes develop later. Rarely the disease shows an abortive tendency but usually it terminates fatally within a few years.

Treatment consists of rest, nutritious feeding, strychnin and reconstructive tonics, together with the mild application of electricity.

PROGRESSIVE NEURITIC MUSCULAR ATROPHY.

This type, spoken of as that of Charcot-Marie-Tooth, rarely declares itself in middle life. Here, the muscles involved early are the peronei, extensor longus digitorum, and the tibialis anticus, thus at times giving rise to some form of talipes. Later, other muscles in the leg and thigh become implicated and finally those of the hand and forearm. Fibrillary tremors are seen, the reflexes weaken and perhaps disappear, and the electrical changes pass gradually into those of degeneration. Frequently the disease is a familial one.

ARTHRITIC MUSCULAR ATROPHY.

This disorder is sometimes present in an active arthritis or it may result from a previous joint disease. It is characterized by a much greater involvement at the proximal side

of the articulation, by the extensors being chiefly implicated, by slight quantitative electrical changes, but without the reactions of degeneration, and by an increase in myotic irritability but with an absence of fibrillary tremors. The tendon reflexes about the joint are often increased and rarely clonus is observed.

Treatment must be directed to the joint, with the judicious application of massage, electricity, exercises and hydrotherapy to the muscles affected.

MYASTHENIA GRAVIS.

This disorder may be encountered in middle life, with its first manifestations appearing not later than thirty years. It is characterized by exhaustion upon slight effort, and by a special electrical response known as the myasthenic reaction; this latter is brought about through faradic stimulation with the result that the muscles soon show exhaustion, and the more rapidly the current is interrupted, the sooner does the exhaustion appear. Etiology is uncertain, but possibly it will later be classed as an endocrine disturbance. The early symptoms are weakness and fatigue toward night which, however, is soon recovered from. Later, when walking, the patient may become so exhausted in his legs as to fall. Not infrequently the facial muscles are the first to reveal the disorder, and weakness of the upper lids or even ptosis with paresis of the ocular muscles and diplopia—asthenia ophthalmoplegia—is not uncommon. Other cranial nerves may be implicated thereby giving rise to difficulty in talking, mastication, and deglutition. Slight exertion may cause dyspnea and tachycardia. The tendon reflexes are present though easily exhausted, but sensory changes are wanting. An interesting leucocytosis is sometimes observed. Pain may be complained of and atrophy and fibrillary twitching have been noted.

The most important diagnostic point in myasthenia gravis is the early exhaustion of the muscles through faradic stimulation, which, however, is soon recovered from. Some differentiation may be necessary from bulbar paralysis, brain lesions and hysteria. Rarely, there has been observed cessation of the disorder, but generally it proves fatal, occa-

sionally in five or six months; however, more commonly it endures for many years.

The *treatment* is rest, full doses of strychnin, the mineral tonics, careful feeding and possibly artificial feeding late in the disease. If an endocrine imbalance can be demonstrated, an effort should be made to overcome it.

PROGRESSIVE BULBAR PARALYSIS.

This is a glosso-labio-laryngeal paralysis of the degenerative type with the seat of the disorder in certain of the motor cranial nerve nuclei—VII, IX, X, and XII—but without sensory involvement. It is only occasionally that the disease is met with and then usually late in middle life. As to cause, there must be some weakness of the nervous elements to permit of such a premature decay. Exciting causes may be overuse of the muscles involved, trauma, emotion, and perhaps some toxic substance, either exogenous or endogenous.

The muscles of the lips, jaws, tongue, palate, pharynx, and larynx, first show fatigue, then exhaustion, and finally paralysis with accompanying loss of function which results in the defective action of speech, mastication and deglutition. The muscles affected become the seat of minute fibrillary tremblings and show partial reactions of degeneration. The speech assumes a nasal twang, food enters the nose, and drooling occurs. Emotionalism is the only mental manifestation. Ultimately, the jaw drops, the tongue atrophies and lies motionless in the mouth, and the soft palate becomes paralyzed. Finally, the patient cannot speak or swallow and his helplessness becomes truly pitiable. Rarely, the oculomotor nuclei are affected, and sometimes the disorder is associated with amyotrophic lateral sclerosis or progressive muscular atrophy. While the disease may show temporary abatement, it is found to terminate fatally in from one to four years, with death resulting from inanition, pneumonia, or some intercurrent affection.

The earliest possible recognition of progressive bulbar palsy is of especial importance in relation to life insurance and industrial accidents, and with this thought in mind fibrillary contractions should be carefully sought for, any beginning change in mechanical and electrical muscle con-

tractility should be noted, together with difficulty in the pronunciation of linguals and labials.

Diagnosis is attended by but little difficulty since only one disorder, pseudo-bulbar palsy, shows much similarity and this disease is produced through bilateral lesions in the cerebrum. Here, there is an obvious mental defect with an absence of rapidly progressive paralysis and atrophy, fibrillary tremors and the electrical reactions of degeneration. Myasthenia gravis may possibly need some differentiation. Rarely, there is an acute bulbar paralysis and this results from hemorrhage, thrombosis, softening or infection, but with these the onset is sudden and there is likely to be some sensory involvement. The management of such a patient is difficult and often artificial feeding must be resorted to early. Medicinally, strychnin, arsenic and phosphorus are indicated, and the tonic effect obtained through the physiological methods of massage, hydrotherapy and the galvanic current, is helpful.

DISEASES OF THE SPINAL CORD.

MYELITIS.

Inflammation of the spinal cord, though not common, may occur as an acute, subacute or chronic disease. It may develop at any level—cervical, thoracic, lumbar, or sacral—and transversely, it may involve a part or the entire cord. It may be localized or diffused, with the process extending either upward or downward. Myelitis more commonly affects men and is most frequently met with in middle life. The causes are many but usually it is a secondary affection. The condition has followed infectious diseases and pus producing conditions on the surface or anywhere within the body. Fracture-dislocations and even traumata unattended by bone lesions have preceded it. It may be an extension from the various forms of meningitis, such as tuberculous, syphilitic, pyogenic, and epidemic; it is said that pus may extend from the periphery through the course of the nerve trunks. Myelitis has accompanied rabies and even exposure to cold is said to have precipitated it. A condition spoken of as myelomalacia is a softening of the cord result-

ing from embolism and thrombosis, and in this the symptoms closely resemble those of myelitis.

Manifestations vary widely depending upon the cause, site and extent of the disease process, but most frequently it is the thoracic or the lumbar cord that is involved. Sometimes the disorder begins with malaise but soon numbness and weakness are experienced, following which there develops paralysis of sensation and motion, together with bladder and rectal disturbances and possibly with vasomotor manifestations. An encircling band of anesthesia often corresponds to the level of the lesion and above this is sometimes found a zone of hyperesthesia. The muscles controlled from the area of the lesion show atrophy, reactions of degeneration and loss of reflexes, while those controlled from below the disease are usually spastic, with increased reflexes and finally with contractures. Sometimes the symptoms partake of the Brown-Séquard syndrome.

A transverse lesion of the cervical region may be distinguished by pain, hyperesthesia and anesthesia in various parts of the upper extremities with anesthesia in the body and lower extremities; paralysis of motion in the arms, neck, trunk, diaphragm, and legs; atrophy confined largely to the arms and for the most part attended by reactions of degeneration; the reflexes usually are lost but later show an increase; disturbances of the bladder and rectum; priapism is often present, and sometimes there are pupillary changes.

A transverse lesion of the thoracic region yields pain and hyperesthesia around the abdomen and back; paralysis of some of the thoracic, abdominal and intercostal muscles; atrophy of some of the thoracic and abdominal muscles, and possibly slight atrophy in the legs with corresponding electrical changes; reflexes are lost at first but later they may be increased; there are bladder and rectal disturbances, and priapism is frequently present.

A transverse lesion in the lumbar region gives pain in the legs, hyperesthesia around the loins, with anesthesia in the legs wholly or in part; paralysis of motion usually amounts to a paraplegia with clonus and the Babinski sign, some atrophy, loss of reflexes, and with changes in the elec-

trical reactions; also, there are disturbances of the bladder and rectum.

Some differentiation may be required from meningitis, multiple neuritis, Landry's paralysis, poliomyelitis, and possibly from hysteria. In course the disease is variable, with lesions of the cervical region showing the greatest mortality. The higher the temperature rises and the more extensive the paralysis, the greater is the danger. After a few weeks the patient may show some improvement, which is first to be observed in the sphere of sensation and later in that of motion. If the individual progresses favorably, he may later be able to be about though usually with some disability. Others may become bed-fast, develop sores and cystitis, and ultimately die.

Treatment consists in rest upon a water-bed with cupping of the spine, purgation, diaphoresis, urotropin, and with most careful attention to the bladder; if bed-sores and contractures threaten, they must be vigorously combated; later, strychnin, iodids, and physiological therapy may prove helpful.

Compression Myelitis. One of a number of causes may be operative in bringing about a slow and continuous pressure upon the cord, such as bony growths, tuberculosis or syphilis of the vertebræ, membranes or cord, from tumors and cysts, and from an aortic aneurism. Pain and rigidity of the back are often present, together with shooting pains and muscular twitchings in the extremities. Sometimes deformities of the spine develop. Generally, there is spasticity in the parts supplied below the lesion and sensory changes may be present. The spinal fluid should be examined and x-ray studies made. In some instances the pressure may be relieved as in tuberculosis of the vertebræ and in certain operable tumors. When an acute myelitis develops, it must receive prompt and careful attention.

Chronic Myelitis. This may result from the acute form or it may be primary. The symptoms, which are very gradual in their development, consist of vague pains, numbness, weakness, later sensory disturbances and atrophy followed by some changes in the electrical reactions. Ultimately, the sphincters may be involved and the patient may become bed-fast. Certain other chronic nervous diseases

may require differentiation, such as meningitis, the muscular atrophies, lateral sclerosis, and symptomatic disturbances produced by some form of compression. The disease is often long drawn-out and treatment is that of other chronic paralytic and bed-fast patients.

HEMATOMYELIA.

Hemorrhage into the structure of the cord sometimes results from trauma, which is not necessarily attended by fracture-dislocation, and it may follow upon unusual physical exertion or excessive sexual intercourse; it may be secondary to diseases of the blood-vessels, diseases of the cord itself, or to neoplasms; it has followed exposure to high atmospheric pressure, and has resulted from convulsive disorders. Hematomyelia may occur as a single hemorrhage, at times extending for considerable distance, or there may be several foci. Hemorrhage into the cervical cord is the most dangerous.

The onset is sudden with weakness and numbness in the extremities, which is soon followed by motor paralysis, sensory disturbance and sphincteral implication. The reflexes are at first lost, but later return, and then become exaggerated. Symptoms vary somewhat depending upon the extent and site of the lesion. Sometimes acute myelitis develops, with death following rapidly. The treatment is that of acute myelitis.

LANDRY'S PARALYSIS.

This disease is an acute and probably an infectious process, characterized by rapid progression, generally ascending but occasionally descending, sometimes attended by an advancing anesthesia and usually, rapidly fatal. Recent investigations incline one to the belief that many, and perhaps most, cases develop upon an acute poliomyelitic basis; rabies also, has been known to show these symptoms. The picture presented is somewhat like that of multiple neuritis, either with or without myelitis, and often with febrile symptoms. The affection begins abruptly with flaccid paralysis, which usually appears first in the lower extremities. Numbness and

paresthesia are present, and often anesthesia, but seldom is there pain. The reflexes are abolished but the electrical reactions are unchanged. The disease extends rapidly to the thigh muscles and then to those of the trunk and abdomen. Soon the thorax and arms are involved, the latter being implicated in the same direction as were the legs. In all of these parts the muscles are perfectly flaccid. Only very rarely do the bladder and rectum become paralyzed. The power of deglutition is often lost. It is but seldom that the cerebrum becomes implicated, so that the patient remains conscious almost to the last.

Some differentiation may be necessary from acute poliomyelitis, acute myelitis, and multiple neuritis. Usually, the course of the disease is rapidly fatal in from a few days to perhaps two weeks, though abortive types are occasionally encountered. Death generally comes suddenly either from failure of respiration or heart action.

Treatment is not successful, but the patient should be placed on a water-bed, carefully fed and nursed, and internally urotropin should be administered.

CAISSON DISEASE.

Among the numerous affections induced through occupation is that of air pressure paralysis. Occasionally, one finds this disorder arising in miners, divers or tunnel workers, who after having been under heavy atmospheric pressure, come too suddenly into the normal atmosphere. The decompression is sometimes so rapid as to lead to points of softening, particularly in the posterior and posterolateral columns of the cord. The nitrogen gas which cannot be eliminated with sufficient rapidity through the lungs, accumulates as gas emboli, which have been demonstrated not only in the arterioles of the cord, but also in the heart and mesentery. There may be free hemorrhage into the cord. The symptoms appear rapidly, beginning with pains in the legs and abdomen, and sometimes elsewhere in the body. Soon the patient begins to stagger, paralysis sets in, and anesthesia appears in the body though the pain continues. The sphincters may relax. Less conspicuous are the cerebral symptoms, which consist of vertigo, headache, prostra-

tion, vomiting, double vision, and difficult breathing. The patient may develop an acute myelitis, become comatose and die in a few days. Others recover with a slight residual chronic myelitis, and mild cases are often completely restored.

Among workmen who are habitually exposed to high air pressure, the return to normal atmosphere should be gradual, and some far-seeing employers have had a cabinet especially constructed to meet this condition. After the accident has occurred, ergot in large doses should be administered, the extremities bandaged, and if a myelitis develops, appropriate care and treatment must be given.

SYRINGOMYELIA.

Syringomyelia, an uncommon nervous disease, is due to cavity formation in the spinal cord, which extends longitudinally for considerable distance, and is characterized by a loss in pain and temperature sensations—dissociation anesthesia—in any part of the body, trophic disturbances and a progressive muscular atrophy which is attended by paralysis. The more usual location for the cavity is in the lower cervical or thoracic regions, and in the less severe cases with an involvement of not more than five or six segments of the cord. Sometimes there is an upward extension into the medulla and even into the pons, and two or three separate cavities may exist. Transversely, the opening is usually situated near the central canal, with asymmetrical extensions into the anterior and posterior gray matter, and perhaps into the white columns.

Usually, syringomyelia develops early in middle life and it may extend through this entire period. The disease is more common among men who have subjected themselves to great physical effort or who have sustained an injury. Such causes together with intoxications and infections, may act upon an inherently weak nervous system and bring about the disorder. The symptomatology is extensive and irregular. In development it is insidious, with aches, pains and paresthesias in the upper extremities and neck as its first manifestations, following which, atrophy slowly appears with a corresponding weakness. The most striking feature is the presence of irregular areas where pain, heat and cold sensa-

tions are only slightly if at all recognized, but where touch is preserved, so that occasionally burns or other injuries are brought about unawares. Sometimes burning pains are experienced in the affected members, and the development of atrophy, which is more common in the arms, may also appear in the back and give rise to a scoliosis. Reflexes that are first diminished, later disappear. Fibrillary tremors may be observed and finally there are reactions of degeneration, so that the picture in part may be that of amyotrophic lateral sclerosis. Trophic disorders in the form of glossy skin, and herpetic and bullous eruptions, may appear. There has been observed a Charcot joint in the spine and elsewhere. When the trophic disturbances are pronounced, leading to atrophies, hypertrophies, felons, affections of the nails, necroses and deformities, the type is that of Morvan, and here care must be exercised lest the disease be confounded with the anesthetic type of leprosy. Ultimately, cystitis, bed-sores and incontinent sphincters warn of the approaching end. Involvement of the first thoracic segment may cause sympathetic paralysis with its narrowing of the palpebral fissure, retraction of the eye-ball, tardy action of the pupil and defective dilatation, disturbance of sweat secretion and flattening of the face.

Syringobulbia results from extension of the process into the medulla, with the development of tremors in the tongue and facial muscles, with atrophy, nystagmus, ocular paralyses, and dissociation of sensation in the head and face. Occasionally, the vocal cords are implicated, difficult swallowing and disturbances of respiration and heart action usually develop. This type is the most rapidly fatal.

In the early stage some differentiation may be necessary from other diseases showing marked sensory changes, later from other progressive spinal atrophies, from cervical pachymeningitis, and in the bulbar type from bulbar paralysis. Without bulbar involvement, the disease is often of long duration. A very few cases may abort and temporary arrest in its progress is not infrequent. Through care, some of the trophic lesions may be prevented, but since there are no special remedies, treatment must be symptomatic.

LATERAL SCLEROSIS.

Lateral sclerosis is characterized by a bilateral spasticity, affecting first and chiefly the legs, and attended by weakness, increased reflexes, clonus and the Babinski sign, but without sensory disturbance, except for a little pain, or visceral implication except in the late stage. The disorder is most common early in middle life but is rare as a pure type, it being more frequently associated with other cerebral and spinal diseases. The early symptoms are weakness and stiffness in the legs and this may be attended by slight pain. The gait is rather distinctive—the feet are shoved forward as though glued to the ground, and since the toes cannot leave the ground, the shoes are worn off in front. The adductor muscles are contracted so that the knees are approximated and the legs may even be crossed, thus giving rise to the so-called scissors gait. Muscular atrophy is absent and the electrical reactions are normal. The disease often lasts for years, with the patient finally becoming bed-fast. The upper extremities may be involved late. Treatment consists in the use of such measures as rest, hydrotherapy and massage, together with the special exercises known as motor training. Any evidence of syphilis should be met promptly with specific medication.

AMYOTROPHIC LATERAL SCLEROSIS.

This progressive degenerative disease is almost invariably one of middle life, with the male sex predominating. The disorder is due to chronic vascular changes which involve the lateral columns of the cord and anterior horn cells, the latter implication giving rise to a progressive muscular atrophy. Sometimes there is associated a degeneration of the cranial motor nerve nuclei, in which event the disorder includes a progressive bulbar palsy.

With an inherently weak motor system, such causes as exposure, trauma, infections and intoxications may excite the disorder. The progress of amyotrophic lateral sclerosis is by no means uniform, but often the first evidence is stiffness of the hands and later it is observed that the small muscles are undergoing atrophy, which gives a claw-like

appearance to these extremities. Soon the forearm is invaded and perhaps the shoulder girdle, with fibrillary tremors appearing. Occasionally the legs are first affected with a gradually developing gait that is spastic-paretic in character, increased knee-jerks, ankle clonus and the Babinski sign. It is only late that atrophy and fibrillary tremors appear in the lower extremities. Reactions of degeneration in the muscles are only present in advanced cases but there is an earlier quantitative decrease to both the galvanic and faradic currents. Talipes and lordosis may develop. There is no distinct sensory involvement though paresthesias, aches, pains and cramps are sometimes complained of. The sphincters remain intact.

Some differentiation may be necessary from a primary spastic paralysis and a chronic muscular atrophy. The disease usually lasts for years with its progress occasionally abating, but when there is bulbar implication, death may be only a matter of months.

Treatment consists in nutritious food, tonics, and the judicious employment of massage, hydrotherapy and electricity.

COMBINED SCLEROSIS.

In this disease a diffuse sclerosis implicates chiefly the posterior and lateral columns of the spinal cord, with a resulting ataxic paraplegia. In a few cases the basic cause appears to be an endarteritis of the spinal vessels. It may, however, develop upon a luetic basis and then the condition approaches the Erb type of spastic paraplegia. Combined sclerosis has been known to follow intense physical effort and finally to develop in the course of a prolonged and exhausting disease. For the most part it is a disorder of middle life, with the male sex predominating. The symptoms vary as to whether they more closely simulate locomotor ataxia or lateral sclerosis. The disorder begins with weakness in the legs, early fatigue, and soon an unsteady gait. Romberg's sign is present, the knee-jerks are plus, and an ankle clonus and a Babinski sign can be elicited. While the disease is not a painful one, some aching and paresthesias are experienced. There is some disturbance of sensation, especially in the feet and legs, where the senses of vibration and

touch are impaired and perhaps wanting. Nystagmus and optic atrophy have been recorded. Finally, the sphincters become implicated and cystitis may develop. The patient becomes bed-fast, the legs—which are now paralyzed and drawn up—are the seat of painful spasms, and even with the best of nursing, bed-sores may develop. Usually, the disease lasts for some years with death resulting from exhaustion, complications or some intercurrent affection. Rarely, a mild case may recover. Early in the disease a differentiation from tabes, other scleroses and multiple neuritis may be necessary. If the disorder has developed upon a luetic basis, some benefit may result from specific medication, otherwise the treatment is symptomatic and supportive.

A subacute, combined degeneration of the spinal cord, associated with pernicious anemia, is important. The disease is characterized by a rather rapid loss of the vibration sense and the sense of position, together with disturbances of the sense of touch and of superficial pain. The posterior and sometimes the lateral columns of the spinal cord bear the brunt of the disease process, though the nerve roots, posterior and even anterior, may be implicated, and not infrequently the peripheral nerves show degeneration. It is estimated that three-fourths of the cases of pernicious anemia present changes in the nervous system, but the severity of these symptoms need not keep pace with the blood picture. The disease is distinctly one of middle life, occurring most frequently between forty and fifty years, with women the more commonly affected. The early symptoms are paresthesias, often appearing as numbness and cold, most commonly beginning in the feet and sometimes spoken of as stocking- or glove-like. A girdle sensation is experienced and associated with this are weakness, shortness of breath, sometimes gastrointestinal disturbance, perhaps a lemon-colored skin, and beginning bladder and rectal incontinence. The disease progresses and the patient develops ataxia. It is rather the rule that the reflexes are increased early, and later diminished or even lost. Neuralgic pains are common. Occasionally, epileptiform seizures occur and more rarely an optic neuritis develops. A loss of the senses of vibration and of position is quite distinctive, and when to this is added

the characteristic blood picture, no doubt may remain as to the diagnosis. Generally, the disease is progressive although remissions may occur, which, for the most part, apply to the general condition, since degenerated nerve fibers cannot be restored. The disease usually terminates fatally in from one to three years, and death may result from cerebral hemorrhage, but more usually it is the outcome of a slow asthenia with the occasional development of bed-sores and cystitis.

Treatment for the most part is that of the underlying condition and for this purpose cacodylate of sodium and neosalvarsan may be used. Normal salt solution, in the form of hypodermoclysis, is useful, and for the disability, massage and exercises are to be employed.

SPINAL MENINGITIS.

This disease, which may be acute or chronic in its course, may result from syphilis, tuberculosis or malignancy of the spine, or of the membranes; it may extend from the cranial cavity or from septic foci in the body by traversing the course of the nerves or of the blood-vessels; through the medium of the blood it may be carried from a pneumonia or from other infections, and it may follow trauma. The pathology differs, pus being found in some cases, but this is not encountered in the tuberculous form, when, however, miliary tubercles are met with. Myelitis may result and may be attended by softening of the cord and destruction of the tracts and gray matter.

Sometimes the disorder is ushered in abruptly, at others it begins with malaise. Soon there appears tenderness along the spine while pain, shooting sharply into the extremities, may be experienced. The neck and back become rigid and the position of opisthotonos is often assumed. The muscles of the limbs and abdomen show spasms, and implication of the bladder and rectum may lead to retention of urine and feces. Pulse and temperature are variable. At first the reflexes are increased but ultimately they may be abolished. Kernig's sign can be elicited. Scratching the skin with the finger nail leaves behind a streak of hyperemia. Paresis, and later paralysis in the form of paraplegia, may appear.

Following a lumbar puncture, the spinal fluid often yields evidence of diagnostic importance. In the adult, meningococci but seldom give rise to meningitis; however, when this condition arises, the spinal fluid is observed to flow rather faster than normal, it is usually milky or creamy, the specific gravity is generally increased (sometimes to 1.008), there is commonly a polynucleosis and perhaps pus, albumin varies greatly in amount, and the meningococci are easy of recognition. In tuberculous meningitis the fluid—which generally is clear—is under great pressure, the specific gravity is high (at times up to 1.012), a lymphocytosis is usually present, but the tubercle bacilli, though present, are difficult of demonstration.

It is important to distinguish meningismus, a condition which sometimes attends infections; such manifestations are not serious and a lumbar puncture reveals normal spinal fluid. Spinal meningitis may prove fatal in a few days and this is especially likely to occur when there is implication of the bulb; a myelitis gives grave complications.

Treatment should consist of absolute rest on a water- or an air-bed, with the patient in such position as may afford most relief from his suffering. Ice-bags, leeching and mercurial inunctions can be applied to the spine. Internally, urotropin and bromides, with the possible addition of morphin for the pain. Lumbar puncture sometimes affords relief. Special conditions, such as cystitis and bed-sores, must be dealt with as they arise.

Circumscribed Serous Meningitis. Locally, occasionally there is found a collection of fluid beneath the dura, in diseases of the vertebræ and of the meninges, in syringomyelia and in tabes, and a similar condition has been observed in the pia-arachnoid. Edematous fluid may likewise collect during infections, after trauma, and it may arise spontaneously. Such collections of fluid may be more or less diffuse. The attending symptoms being much like those resulting from tumor, errors in diagnosis have arisen. Sometimes the symptoms show a tendency to fluctuate and this should cause one to suspect the condition of circumscribed serous meningitis. Treatment is evacuation through operation.

Chronic Spinal Meningitis. In a few instances this disorder results from acute meningitis and from trauma, but more commonly it is caused directly by syphilis or tuberculosis, or extension of these diseases from the vertebræ, and rarely it may result from pressure of a tumor or aneurism; it may also accompany tabes and diseases of the cord. The symptoms consist of sensory changes (either an increase or a decrease), motor disability, and perhaps bladder and rectal disturbances. Pain is conspicuous and this may extend from the cervical and thoracic regions into the extremities. Paraplegia sometimes develops and the patient may be unable to be about. Treatment in an advanced case is that of other bed-fast paralytic conditions, together with counterirritation to the spine and such special measures as its primary cause may require.

HYPERTROPHIC CERVICAL PACHYMEINGITIS.

While this is a rare disease, it concerns us for the reason that the middle decades of life are particularly liable to the effects of its etiological factors, which are syphilis, trauma, alcoholism, and exposure, and consequently with such causes the male sex must predominate. The dura becomes thickened and the pia adherent, which mass later involves the nerve roots and the cord. The early symptoms are those of irritation while the later manifestations are those of compression. First, there is hyperesthesia and pain in the neck, shoulder or arm, which may be accompanied by muscular twitchings and later by atrophy. The cervical spine is stiff, tender, and sometimes it is laterally deviated. There may be involvement of the cervical sympathetic and finally a spastic paraplegia with its attendant phenomena may develop. The sensory changes are variable, sometimes sensation is delayed, and in other instances there is dissociation. While the cervical meninges are the site of predilection, one must bear in mind the possibility of the lesion developing lower, with the symptoms corresponding to that of the level implicated. Prognosis is unfavorable except in the few instances where the condition may be an operable one. Luetics should receive active specific medication, and in the event

of appearance of the much dreaded symptoms of cystitis, paralysis of the bladder and bed-sores, these must be energetically met.

TUMORS.

Tumors of the cord occur much less frequently than do those of the brain, but they are more operable and for this reason their early recognition is important. They are met with most frequently between thirty and fifty years, and are distributed about equally between the sexes. These growths are of various kinds, such as glioma, sarcoma, psammoma, angiosarcoma, carcinoma, gumma, tubercle, parasitic, cystic, osteoma, and chondroma. The growths proper are commonly divided into hard and soft tumors. Malignant growths may be either primary or secondary, and cystic growths occasionally result from traumatism. These offending bodies develop within the cord and within the dura, or they may appear extradurally.

The symptoms produced are pain, hyperesthesia, hypesthesia, motor phenomena such as paresis, paralysis, spasms, twitchings and spasticity; changes in the reflexes of the extremities and sometimes of the abdomen and scrotum; atrophy, trophic disorders and visceral disturbances. The symptoms vary with the level of the lesion and to some extent with their transverse site. Pain is an early, persistent and troublesome feature, often agonizing in its intensity; it is due to irritation of the sensory roots or to involvement of the sensory tracts of the cord; the pain is usually shooting in character and at first is likely to be unilateral; in the beginning its origin is obscure and often passes for rheumatism or sciatica. Where implication is largely in the anterior part of the cord, pain is sometimes absent. Other sensory manifestations are hyperesthesia at about the corresponding surface level, with hypesthesia or anesthesia below and these are apt to be segmental in their distribution. A unilateral lesion will often yield the symptoms of a Brown-Séquard paralysis. With involvement of the anterior part of the cord the motor symptoms predominate, such as paresis, spasticity, and possibly compression to the extent of a paraplegia; often the reflexes are increased and the Babinski sign and clonus

may be obtained. Implication of the bladder and rectum are not infrequent, with bed-sores developing late. Except for a gumma and tubercle which appear rather rapidly, tumors are usually slow in their growth and progressively worse in their course.

An early diagnosis, though surgically most desirable, is seldom made. There should be x-ray studies, which, however, are most helpful in the matter of excluding bone disease. Xanthochromia in the spinal fluid often speaks of an extramedullary growth and a lumbar puncture may yield other important information, particularly in cases of suspected gumma. A history of previous syphilis should be considered and a primary growth in another part of the body may be the origin of the trouble. If the tumor is of rapid development and is multiple, it may be sarcomatous in nature. Some differentiation may be necessary from tabes and neuralgic disorders; from meningomyelitis and pachymeningitis; multiple sclerosis and syringomyelia should be readily ruled out; a compression myelitis and particularly a circumscribed serous meningitis must be considered.

Treatment. If the lesion is gummatous, antiluetic measures should be adopted. After the site has been determined, at least an exploratory laminectomy may be done. In inoperable cases, cutting of the implicated posterior roots, and even an incision into the anterolateral column of the cord, have been employed for the control of intractable pain. A few tumors are operable early, notably the fibroma, psammoma, osteoma, lipoma, and cyst, and fortunately for surgical approach the greater number of them lie laterally or posteriorly, and by far the larger number are extramedullary. An intramedullary growth cannot be satisfactorily removed.

FRACTURE-DISLOCATION SYNDROMES.

Injuries to the spine resulting in cord symptoms may be due to falls or blows, to forcible movements, and to cutting instruments, or bullets. Sometimes the cord sustains only a bruise but there may result a laceration or hemorrhage, and occasionally the cord substance is more or less completely divided. Even complete severance of the cord is not

incompatible with life, since patients have lived for many years after, though, of course, with great disability. An injury may occur at any region along the spine, but the thoracic region, owing to its greater exposure, is a quite common site. The higher the seat of injury the greater the danger, and if above the fourth cervical vertebra, death usually follows rapidly from failure of respiration.

Symptoms vary greatly, depending upon the level of the lesion and upon the extent of transverse involvement of the cord. An injury high in the cervical region may involve the phrenic nerve directly, with death following promptly, or from an injury somewhat lower there may be upward extension of inflammation and so implicate the phrenic nerve. Priapism most commonly results from involvement of the cervical segments of the cord. Lower in the cervical region and high in the thoracic, arise the fibers of the cervical sympathetic nerves, disturbance of which yields the well-known ocular phenomena. In the "dorsolumbar" region the anesthesia usually reaches as high as the superior spines of the iliac bones and possibly upward to the umbilicus. Injury at the level of the lower three lumbar vertebræ may yield the saddle-like patch of anesthesia around the anus and the gluteal and perineal regions. It is generally recognized that a complete anesthesia—pain, touch and temperature—of a skin zone can only result from the implication of three successive nerve roots. Rapid disappearance of symptoms is indicative of hemorrhage and is regarded as a favorable omen.

At first there is likely to be flaccid paralysis, loss of reflexes, and incontinence of the bladder and bowel, with sensory loss below the lesion and an area of hyperesthesia at the level of the lesion. Later, a spastic paralysis often ensues. An injury approximating a hemisection of the cord will cause the Brown-Séquard syndrome; this consists of sensory changes on the side of the lesion, showing at that level a band of hyperesthesia, and beneath this one of anesthesia, paralysis on the same side without atrophy, reflexes are lost at first, but later return and finally become increased; on the opposite side of the body, below the lesion, there is loss of pain and temperature sense and perhaps of the sense

of touch. Careful x-ray studies should be made. If the patient survives a severe injury, more or less permanent disability usually results.

The *treatment* consists in rest upon a water-bed and such other attention as is accorded an acute myelitis, otherwise, the treatment is surgical.

VASOMOTOR AND TROPHIC DISEASES.

RAYNAUD'S DISEASE.

This disorder, also known as symmetrical gangrene and local asphyxia, is rare but may be met with early in middle life, and women are the more frequently affected. It usually appears in individuals of a psychopathic makeup, and psychic trauma may cause the disorder to develop; it has been observed in hysteria, epilepsy and acute mania; also in the organic diseases of tabes, myelitis, multiple sclerosis, in diseases of the blood and in infections; an arteriosclerotic condition may aid in its development. The fingers and toes are most commonly affected, but other extreme points of the body—as the ears, nose, tongue, and genitalia—may be the seat of the disorder; rarely it may occur elsewhere on the body surface and possibly in the interior. Although there may be abortive attacks, in the complete process, three stages are observed: local syncope, local asphyxia, and local death. First the affected part becomes death-pale, then in a few minutes or perhaps hours cyanosis develops, following which vesicles appear and break down and some days after this gangrene may ensue; later, the area heals with cicatrization. Blood may appear in the urine and there have been observed attacks of transient hemiplegia or migraine. The lesions vary greatly in frequency and in intensity.

Treatment must if possible be directed to the underlying cause. When the pain is intense, morphin may be necessary; where the psychic element is pronounced, psychoanalysis has proved useful. Such measures as diathermia, hydrotherapy, electricity, and the intermittent bandage of Cushing should be employed.

INTERMITTENT CLAUDICATION.

The disorder of intermittent limping is for the most part limited to middle life, and is due to insufficient circulation in the calves of the legs and sometimes in the feet. It arises from spasm of the arteries of the nerves supplying the implicated muscles, from an arteriosclerotic process in these arteries, or from arteriosclerosis of the cord. The manifestation is prone to appear after physical exertion and is often preceded by paresthetic sensations; the muscles may cramp and in the milder cases the attack passes away with rest. In the more severe form there is an absence of pulsation in the dorsalis pedis artery and sometimes also in the posterior tibial, both of which may be rigid. Intermittent claudication has also been met with in the upper extremities. The use of alcohol and tobacco, and the presence of flat feet, are said to be factors in its causation. From Raynaud's disease and from erythromelalgia it may require some differentiation.

The affection must be combatted with hydrotherapy, diathermia, massage, electricity and good hygiene.

ANGIO-NEUROTIC EDEMA.

These attacks of local edema, fugacious in character, are largely confined to the middle period of life, with the female sex predominating. They develop in neurotic individuals and sometimes there is shown an hereditary influence. The affection is characterized by suddenly appearing edematous swellings in the skin, attended by changes in color and temperature, and by an interference with the function of the part. The indurations which develop do not pit on pressure. Sudden exposure will precipitate an attack, and while any part of the body may be affected, it is most common in the hands and feet. The color varies from pale yellow to bluish-red, the local temperature is lowered, a sense of discomfort is felt and burning pain may possibly be experienced, but an actual anesthesia is rare. While attacks do not usually last more than a few hours—possibly days—their inopportune appearance sometimes leads to much apprehension upon the part of the patient. Urticarial manifestations may be experienced. The disease is not without danger, as, for instance,

when the larynx is attacked; then the pharynx, gastrointestinal tract and even the brain, it is said, have been the seat of these swellings.

Treatment. with involvement of the larynx, might be operative. If the pain is intense, morphin may be required; otherwise the management must be that adapted to other neurotic individuals.

ERYTHROMELALGIA.

This disorder is rare but may be encountered late in middle life, with males the more commonly affected. It is a chronic disturbance, characterized by attacks in which a part becomes red and hot, and is attended by an agonizing pain; the latter is much aggravated by a dependent position. The feet are the more commonly affected, and owing to the active hyperemia present there may be some local rise in temperature. Local sweating is sometimes present, as is also slight swelling. The affection occurs in neurotic individuals and can result from chronic cord diseases, infections, physical and mental strain, and exposure.

Treatment. There must be rest of the part, and cold affords some relief. Hydrotherapy, massage and electricity, and the application of the intermittent bandage of Cushing may be tried.

SCLERODERMA.

Scleroderma, though rare, is by preference a disease of middle life, with women its most frequent sufferers. While the manifestations of this affection fall for the most part within the domain of dermatology, its origin is usually to be found in the sphere of neurology, since its progenitors have been diseases and injuries of the spinal cord and peripheral nerves, physical and mental strain, and endocrine disturbances. Exposure and the infections have likewise been held responsible for its development. The first symptom is usually pain in the implicated part, or sometimes the patient's attention is attracted to an indurated area in the skin which later becomes thickened and shows a pronounced luster; the skin is rigid, cannot be picked up, and does not pit on pressure. Sometimes irregular areas of pigmentation are seen,

and disturbances of sweat, growth of hair, and vasomotor changes, may appear.

Lesions are not absolutely confined to the skin, since the mucous membrane, muscles and joints have been observed to be implicated. When the disorder affects chiefly the hands or possibly the feet, sclerodactyle is spoken of, and here thickening and deformity results. A local type, occurring somewhat earlier in life and known as progressive facial hemiatrophy, has been described; in addition to atrophy (even of the bones), there are secretory and trophic changes. A few mild cases may recover but where the skin is distinctly hidebound the affection becomes very chronic, though perhaps with slight remissions.

Treatment should be supportive and includes tonics, hydrotherapy, massage, electricity, and diathermia, with attention to any endocrine imbalance that may be detected.

SPONDYLOSE RHIZOMÉLIQUE.

This rare affection is probably a form of rheumatoid arthritis, but one which shows pronounced nervous symptoms. Middle aged males are most frequently affected. The disorder is progressive and while it may at first be confined to a particular part of the spine—often the cervical region—ultimately the entire column becomes ankylosed, perfectly rigid, bent forward, and moves as a whole; it has been termed the “poker spine.” Often there is associated ankylosis of the large joints, such as the shoulder and hip, and in advanced cases the jaw may become immovably closed, and the ribs fast at their spinal attachments leaving respiration to be carried on largely through the abdominal muscles. It is generally insidious in onset and the first symptoms result from irritation of the nerve roots, with the patient experiencing sharp shooting pains along the course of the nerve distribution; there may be some additional sensory symptoms such as anesthesia, and even atrophy of muscles has been observed but without reactions of degeneration. Later, when the ankylosis is extreme, the pain usually decreases. Osteophytes have been developed within the spinal canal and have impinged upon the cord substance, thereby giving rise to such symptoms as occasionally result from intraspinal tumors.

Minor infections are sometimes at the root of this disorder so that pus should be searched for around the teeth, in the various sinuses, the tonsils, intestinal tract, ovarian tubes, prostate and seminal vesicles. The discovery and destruction of such sites of infection may in the early stage arrest the disorder; later the treatment must be tonic, supportive, and possibly with inoculations, and with recourse to hydrotherapy, diathermia, massage, and electricity.

SYPHILIS OF THE NERVOUS SYSTEM.

Luetic infection is a prolific source of disease and it is variously estimated that from eight per cent. to twenty per cent. of the cases show involvement of the nervous system. The organism, which is a very motile one, is known as the *Spirocheta pallida*, and the escape of many luetics from neurosyphilis is due to the local action of the antibodies in destroying the organisms. There are reasons for believing that different strains of this organism, or possibly variations of the same strain, may be the cause of different clinical types of neurosyphilis. The manifestations of congenital syphilis almost invariably declare themselves before middle life. Few if any persons who have had neurosyphilis should ever marry. Following infection, evidence of neurosyphilis has been observed as early as ten weeks by Mott, and within three months by Nonne, while, on the other hand, symptoms may not be encountered until many years after infection. A case recently studied by me was that of a convict who had been continuously in prison for twenty-seven years and during which time he had enjoyed good health. Then he had an apoplectiform attack which led to a Wassermann study and he was found to be suffering from neurosyphilis. It was believed extremely improbable that he had acquired syphilis during his incarceration.

In most instances the clinical symptoms will enable one to make the diagnosis, but there are exceptions where the laboratory data aid in arriving at definite conclusions, and certain findings in the blood and spinal fluid occasionally direct attention to a previously unsuspected neurosyphilis. Furthermore, repeated laboratory studies give some indica-

tion as to the progress of the disease and the success of anti-syphilitic treatment. A positive blood Wassermann by no means denotes the presence of neurosyphilis nor does its absence eliminate neurosyphilis. Either a blood Wassermann or a spinal fluid Wassermann may be present without the other and a positive reaction is of much greater value than a negative one. The blood is almost always positive in paresis and in taboparesis; the spinal fluid also is almost always positive in paresis and in taboparesis but not so frequently is it positive in uncomplicated tabes and in cerebro-spinal syphilis.

The pressure of the spinal fluid is increased in paresis and in taboparesis, and usually in tabes, but less frequently so in cerebrospinal syphilis. Nonna regards the number of lymphocytes normally found in the spinal fluid as varying from none to five; from six to ten as borderland; and from ten upward as pathological. In neurosyphilis the increase is sometimes enormous, and this in a measure bears some relation to the activity of the luetic process. A lymphocytosis is with few exceptions indicative of neurosyphilis, and in those syphilitic disorders especially marked by chronicity—as tabes and paresis—it may precede by a considerable period the clinical symptoms of the disease. Therefore, if the spinal fluid speaks of syphilis, one should not wait for the clinical symptoms but should institute treatment at once.

Chemical analysis may show the presence of globulin in normal spinal fluid, but any decided increase is indicative of disease though not necessarily of syphilis. It parallels to some extent the lymphocytosis. In the presence of syphilis the luetin test of the epidermis appears constant, therefore, this is of special value in the few cases showing a negative Wassermann. The colloidal gold test is one of great delicacy and is of most value in making a careful search for the so-called parasyphilitic affections. By the provocative Wassermann reaction one understands the rendering of a negative spinal fluid positive through the injection of arsphenamin or some allied preparation. A more comprehensive term is neurorecidive or neurorecurrence, which signifies the appearance in the course of arsphenamin treatment, of the symptoms of neurosyphilis, usually resulting

from meningeal implication and sometimes with cranial nerve involvement.

Syphilis of the nervous system is often a diffuse process, so that it is generally regarded as difficult to limit the process to definite diseases. For instance, such widely separated manifestations as pupillary changes and disturbances of micturition, nerve root lesions and hemiplegia, frequently occur in a number of the syphilitic diseases. Head and Fernsides mention as early signs and symptoms of cerebrospinal syphilis: Changes in personality and aptitude.—Patients may become entirely untrustworthy, are neurasthenic, attention and concentration are affected and they lose their efficiency. Disturbance of sleep.—A few show a pathologic tendency to sleep, but more commonly there is insomnia; disturbing dreams often occur, and hallucinations amounting to minor psychoses may be encountered. Headache.—The nocturnal feature of this symptom has been given undue prominence; it is paroxysmal, often severe, and is sometimes accompanied by extreme tenderness of the scalp; when in addition there are optic atrophy, nausea and vomiting, the Wassermann test may be needed to eliminate brain tumor. Shivering attacks with or without fever have been observed. Root lesions.—In posterior root involvement neuralgic pains are common and sensory diminution or loss is frequent; attacks of herpes zoster are sometimes observed; involvement of the anterior roots yields motor disturbances and muscular atrophy. Abnormal reactions of the pupil.—Variations as to size, inequality, irregularity and irresponsiveness to light are common. Disturbances of micturition are often early manifestations.

The pathologic types of syphilis of the nervous system are of the more or less benign meningo-vascular type and the malignant parenchymatous type, both of which are sometimes combined, and beside these many atypical forms are frequently encountered.

TABES DORSALIS.

Tabes dorsalis or locomotor ataxia, which perhaps is the most common disease of the spinal cord, is mostly confined to middle life. It is a syphilitic affection, though less than

one per cent. of those infected develop tabes. The disorder is for the most part located in the posterior nerve roots and posterior columns of the spinal cord, but there is also implication of the peripheral nerves and nerves of the special senses. It is more frequent among the metropolitan population and occurs oftener in men. The disease has been known to begin as early as four years after infection, but the average is about fifteen, while in a few patients the first signs have not appeared until many years later. It is notable that in tabes dorsalis the constitutional manifestations of syphilis have been few and sometimes have entirely escaped observation.

The symptoms are conveniently divided into three stages: preataxic, ataxic, and paralytic.

Preataxic Stage. One of the earliest symptoms is pain in the lower extremities. By the laity this is sometimes spoken of as "rheumatic," but the shooting and lancinating character of the pain should cause one to be suspicious of its luetic origin. Usually the disease begins in the lumbar region but rarely it is the cervical roots that are first implicated, in which event the pain will shoot into the upper extremities. A still more rare form is that with bulbar involvement and here a trifacial neuralgia may be the first manifestation. Paresthesias, anesthetics, and hypesthesias are common. Numbness and tingling are frequently experienced. Bands and irregular areas of diminished and even lost sensation are frequent in the legs, soles of the feet, about the chest and below the nipples. Important sensory changes resulting from impaired integrity of the posterior columns of the spinal cord are, diminished appreciation of tuning fork vibrations when this instrument is applied to the surface of a superficially placed bone (as the tibia), inability to properly recognize the exact position into which a segment of the extremity may be placed, and failure to recognize, as two points, the widely separated arms of a compass. Biernacki's sign, an insensitiveness to pressure over the ulnar nerves at the elbow, is an advanced symptom. The tendon reflexes at the knees and ankles are soon lost. Pupillary abnormalities tending toward the Argyl-Robertson type are usually seen. Then there are the various crises, often leading to

errors in diagnosis—paroxysmal attacks of intense pain in the stomach attended by nausea, persistent vomiting and prostration; the bladder, rectum, clitoris and larynx may also be the seat of attacks. Romberg's sign (unnatural swaying of the body when the patient stands with his eyes closed and his feet squarely together), hypotonia and ocular palsies are early symptoms, together with the Wassermann findings and the lymphocytosis in the spinal fluid.

Ataxic Stage. This period, which sometimes lasts for many years, is characterized by incoördinate muscle action. The patient's gait becomes unsteady, he cannot walk well in the dark, he stumbles and soon comes to the use of a cane; the feet are lifted high in the air and the heels are first to touch the ground. While the shooting pains become less pronounced, the paresthesias increase. Disturbance of muscle sense renders it impossible to properly appreciate the position of the extremities. Crises continue, optic atrophy begins and bladder and rectal disturbances become pronounced; vesical incontinence is sometimes so troublesome a feature as to necessitate the patient's wearing of a special rubber device to catch the dribbling urine. Trophic disorders appear in the form of arthropathies with their attending deformities, and the knees in particular are prone to show the Charcot joint. Perforating ulcers of the feet may develop, and various types of muscular atrophy are occasionally encountered. Herpes and other skin lesions appear.

Paralytic Stage. Finally, the patient is no longer able to walk, he takes to a chair and ultimately to bed. Bed-sores appear and while he usually lives for a long time, death, from some intercurrent affection, may occur at any moment.

The course of the disease is variable and if recovery is possible, it is only in the earliest stage. However, much may be done to ameliorate the condition and to prolong life. In those individuals who early develop an optic atrophy, the disease is of longest duration.

Diagnosis. Lost knee-jerks, ataxia, and Argyl-Robertson pupils are almost diagnostic. A possible exception in the early stage is an alcoholic multiple neuritis. Another possibility is a submyxedematous condition, which may yield neuralgic pains, coming and going, absent knee-jerks and

Achilles-jerks, sluggish pupils, some incoördination, and physical and mental fatigue; but here the blood and spinal fluid findings are negative and the disorder responds to thyroid treatment. Tabes dorsalis is at first sometimes regarded as neurasthenia. Because of the various crises surgeons have frequently been led into operations for supposedly local conditions. Sometimes diabetes gives rise to similar symptoms, and the gait in cerebellar disease is occasionally misleading. The type of disease known as taboparesis may develop, in fact paresis may precede, may appear simultaneously with or may follow tabes dorsalis.

Treatment. Because of the chronicity of the disorder and its many complications, much is required in addition to anti-syphilitic measures. Occupational therapy is important, and in the well-to-do a change of climate often affords comfort to these sensitive invalids. By means of special exercises, marked improvement in the ataxia may be secured through reëducation of the muscles. A period of rest in bed with full feeding and massage will give temporary relief. These patients frequent all manner of electrical institutes, with but little relief, except in a psychic sense. Medicinally, salvarsan and its derivatives are used intravenously and intraspinaly, while other preparations of arsenic are employed by injection into the muscles. Mercury is used internally and in the form of inunctions. Potassium iodide should be given at intervals. Systematic spinal drainage is employed by Gilpin and this it is claimed is not only beneficial *per se*, but that it also causes more drugs to pass through the spinal fluid. What is known as the Aachen method includes the systematic inunction of a 33 $\frac{1}{3}$ per cent. ointment of mercury which, under careful medical supervision, is applied by a trained rubber; this is augmented by the internal and external use of sulphur water, which it is believed tends to the formation of a more soluble compound of mercury than is the albuminate. In addition scrupulous attention is directed toward the condition of the mouth, kidneys, heart, lungs, and liver. Such a course may take from one hundred to two hundred days. For the paroxysmal pains, allonal may give relief. As a bed-fast patient, the various procedures that are employed in other paralytic conditions must be resorted to.

PARESIS.

This disease is also known as dementia paralytica, progressive general paralysis, general paralysis of the insane, and by the laity it is frequently spoken of as "softening of the brain." The affection is a chronic, diffuse meningo-encephalitis, characterized by progressive mental enfeeblement, together with progressive paralysis of the entire body. On the whole, the psychic manifestations tend to dementia, but there may appear various phases, such as neurasthenic, hysterical, depressive, or maniacal, and sometimes there is an expansive period showing the classic delusions of grandeur. It has been definitely determined that paresis results from syphilis and it is said to actually develop in about two per cent. of those infected. The disease is most commonly met with between thirty and fifty years and usually appears from four to ten years after infection, with the male sex looming much the larger in statistical studies. Causes which may be somewhat predisposing are, alcoholism, prolonged physical and mental strain, trauma to the head in a syphilitic may favor its development, and such a disease as influenza may precipitate paresis.

While paresis is classed as of the parenchymatous type of syphilis, there are extensive findings in the meninges and in the blood-vessels. The meninges are thickened, opaque and adherent. The brain has lost in weight, the cortex is thinned and the convolutions are atrophied. The pons and medulla are frequently involved, and often implication of the posterior columns of the cord give rise to so-called taboparesis. The ganglion cells are degenerated, as are to some extent their connecting fibers. Also marked evidence of the disease is shown in the blood-vessels. Paresis conforms more or less closely to various types, such as dementive, expansive, agitated, and irregular. The stages of the disease may be conveniently divided into the prodromal period, period of the established psychosis, and the terminal period or that of dementia.

Prodromal Period. Rarely, paresis develops suddenly with an epileptiform or apoplectiform seizure, and it may also be precipitated by trauma to the head, but the more usual course

is with an insidious onset, so that the disorder is sometimes mistaken for neurasthenia or psychasthenia. Often there is insomnia, headache, loss of appetite and digestive disturbances, but soon minor mental defects develop, such as failure of memory, indifference, character changes, intemperance, licentiousness, errors in money matters, and carelessness in dress. Defects in speech and hand-writing occur, and pupillary abnormalities together with ocular palsies often occur. Commonly there is increased reflex tendon activity, diminished cutaneous sensibility, and even lost sensitiveness to pressure, as may be demonstrated by squeezing the testicles. Such a state may last for many months before the more characteristic manifestations obtrude themselves.

Period of the Established Psychosis. This stage of the disorder is characterized by definite mental and physical symptoms. The speech and hand-writing become distinctly "parietic." The patient experiences difficulty in using words containing the letters known as labials and linguals and this may be demonstrated by having him repeat "truly rural," "Methodist Episcopal," "royal artillery brigade," etc. In writing, besides the conspicuous tremor, it is often noticed that letters, syllables and even words are omitted. Tremor of the hands and lips is noticed. The pupillary changes and those of the tendon reflexes become more pronounced than in the preceding stage and trophic disturbances may occur. The mental symptoms previously observed become emphasized and more obvious changes, such as actual delusions, appear. Although a very much changed individual, the patient will speak of himself as exceptionally well. His ideas become exaggerated and he may plunge into gigantic business schemes, even taking with him associates who still have faith in his ability. Soon, however, his conversation and actions excite suspicion and as the disease gradually unfolds itself, it is realized that a mentally deranged man is being dealt with. Hallucinations are not common except in the depressed types. The delusional content of the mind is constantly changing. The patient may believe himself possessed of great physical strength, of commanding personal beauty and great intellectual endowment; that he is some mighty person with countless millions at his command, which he

proceeds to lavish upon those about him; wives and concubines by the hundreds are his. A frequent and a conspicuous feature is emotivity, so that the paretic often changes suddenly from laughter to anger. Grievous offenses are sometimes committed and maniacal outbreaks are common. Optic atrophy may develop and not infrequently tabetic symptoms are associated.

Remissions. This strange circumstance is sometimes experienced after the patient has been placed in a detention hospital and possibly even after he has become bed-fast. Here, mental and physical improvement gradually shows itself until finally the patient regains mental control so that his friends believe him to be perfectly well, but such confidence is usually unwarranted since the individual will almost surely, in the course of a few months or possibly years, have another mental break-down. Rarely, remissions occur more than once, but to the skilled observer there always remains some reminder of the condition, such as pupillary and tendon reflex changes with possibly ataxia and some slight speech defect. If paresis is ever permanently curable, and a few of our best observers believe that it is, it must be early in the disease. Either following a remission or following the progress of the uninterrupted disease, the patient almost invariably arrives at the final stage of paresis.

Period of Dementia. Through his generally progressive disease, the paretic becomes less active physically, his delusions less pronounced and his words scarcely intelligible. Finally, he is a bed-fast dement with complete loss of vesical and rectal control and often with the development of bed-sores.

Diagnosis. In the beginning the disorder may be regarded as neurasthenia or psychasthenia, but the mental and sometimes the moral weakening, together with a study of the blood and the spinal fluid should eliminate these diseases. Chronic poisoning from alcohol or lead may have to be considered, since these also show tremor, disturbances of speech and mental manifestations. Brain tumor and sleeping sickness sometimes counterfeit paresis. An important differentiation is that of cerebral syphilis; here, the manifestations usually appear much earlier and are commonly attended by

headache; it is more likely to involve other cranial nerves than the third, often shows distinct localizing signs, and is much more responsive to treatment. Paresis yields more pronounced mental symptoms and more definite spinal fluid findings. Types of syphilitic psychoses, other than paresis, are sometimes encountered such as simple mental enfeeblement, and paranoid, manic-depressive, epileptic, hallucinatory and confused states.

In course the disease is progressive except in the few instances where remissions occur, and these may last for a few months or possibly for a few years. Paretics usually die in from three to five years, although one of my patients lived for seven years after his admission to an asylum.

Treatment has not proved very successful but the common method has been that of injecting intravenously antisyphilitic remedies, together with mercurial inunctions. Recently, heroic measures have been adopted by means of injecting antisyphilitic remedies every few days, first intradurally, both cerebral and spinal, next into the lateral ventricles through the site of a former decompression, and finally into the cisterna magna. Such substances have also been introduced into the carotids. Ultimately, paretics, except those who are well-to-do, require institutional detention and care, and eventually they must be accorded the same careful attention that is given to patients in other paralytic disorders.

SYPHILITIC CEREBRAL MENINGITIS.

Syphilis of the cranial bones is usually, though not necessarily, accompanied by meningeal involvement, and when a gumma develops in these structures, it commonly gives rise to the symptoms of brain tumor. At the base of the brain is where the meninges are most frequently implicated and the region of the interpeduncular space is the most common site. The usual symptoms are headache, optic nerve involvement either directly or through pressure, with consequent disturbances of vision. The third nerve is frequently affected, thereby showing ptosis and oculomotor palsies. Other cranial nerve implication ranges all the way from the fourth to the twelfth. The mental symptoms are usually minor, though they may vary from apathy to mania. When

the involvement of the meninges is on the convexity, certain symptoms are likely to be encountered, such as convulsions from implication of the motor area, speech defects from the affecting of Broca's convolutions, hemiplegias and monoplegias; then there may be sensory disturbances—anesthesias, astereognosis and optic hallucinations.

CEREBRAL SYPHILIS.

This form is usually also attended by some involvement of the membranes, but the meningitis by no means dominates the picture. Cerebral syphilis is largely a vascular disease whereas paresis is of the parenchymatous type. The symptoms are innumerable and, like those of brain tumor, are divided into general and focal.

The general symptoms are headache which is chronic but intermittent, is often intense and is sometimes worse at night. Vertigo, which may occur with headache or independently, is always aggravated by physical or mental strain. Disturbances of sleep consist of insomnia, which is the rule, but a morbid drowsiness is not infrequent. The mental symptoms are those of slight memory defects, irritability, poor attention and lack of concentration; delirium, stupor and confusion may occur, and an actual psychosis sometimes develops.

Focal symptoms, of which many are possible, embrace all forms of convulsions, hemiplegias, monoplegias, and sensory disturbances including involvement of the special senses. The paralyses are often transient. Apoplectiform and epileptiform seizures may occur and there may be implication of any of the cranial nerves. For a differential diagnosis, a study of the spinal fluid in all of its variations is of the utmost importance.

SYPHILITIC SPINAL MENINGITIS.

This disease is often a part of a meningomyelitis, and frequently it is accompanied by a meningoencephalitis, but there are patients in whom the meningeal syndrome predominates. Percussion over the spine sometimes yields tenderness and this may be intensified at certain points, which

is indicative of a more extensive process involvement. Paresthesias occur in the form of numbness, tingling and coldness, and these are followed by pain which often shoots into the extremities, neck, and body. A gummatous formation may cause the symptoms of tumor, and a diffuse thickening tends towards the spastic-paretic type of gait with an increase of reflex activity and the Babinski sign. If the involvement is far down, often there are vesical and rectal disturbances.

Radicular Type. Sometimes there is special nerve root implication. When it is a posterior root involvement, there are disturbances of sensation in the areas supplied; pain is often a prominent symptom and this is often erroneously interpreted as of rheumatic origin. Implication of the anterior roots leads to a more or less isolated muscular atrophy and reactions of degeneration in parts of the extremities or body.

SYPHILITIC MYELITIS.

In this type the cord involvement predominates over that of the meninges. When the implication is chiefly of the lateral columns, the disorder has been spoken of as Erb's spastic spinal paralysis. Here there is weakness of the lower extremities and stiffness in walking. Paresthesias appear in the legs and dorsum but without anesthesia and pain. The gait becomes progressively more stiff and difficult until finally the rigidity is extreme. Romberg's sign is present, the reflexes at the knees and ankles are exaggerated, there is ankle clonus and the Babinski sign. The sexual power is diminished and the bladder and rectum become involved. Muscular atrophy and the reactions of degeneration are wanting.

The transverse myelitic type yields complete flaccid paralysis below the lesion, also complete sensory loss with associated vesical and rectal disturbances.

Sometimes there is encountered the Brown-Séquard syndrome, due to a unilateral cord lesion, which gives complete loss of power below that level on the same side, with complete anesthesia below the level on the opposite side.

Other possible types are the tabetic, poliomyelitic, and that of amyotrophic lateral sclerosis.

The cranial nerves most frequently affected by syphilis are the optic, leading to optic atrophy; the oculomotor, patheticus and abducens, giving rise to ocular palsies; and the auditory, yielding deafness. The other cranial nerves may also be involved, though their implication is infrequent.

Treatment. Cerebrospinal syphilis should be treated judiciously, and one should remember that sometimes remissions occur without treatment. The disease is chronic and, generally speaking, there is not the urgency for intensive treatment that obtains in the so-called early syphilis; however, if a gummatous formation threatens important structures, the urgency for forceful measures becomes at once apparent. The drugs of first choice are arsphenamin (salvarsan) and neo-arsphenamin, both of which are given intravenously. An arsphenaminized serum is also employed and this may be given intravenously or intraspinaly. Of late, a preparation of silver has come into prominence. Since harm may result, it is well for one to be a bit conservative about these injections, beginning with one injection every two weeks and during the interval using mercury either in the form of inunctions or injections. Since the susceptibility to mercury is increased by the use of arsphenamin, and also because the prolonged mercurialization is of itself at times debilitating, it is well to employ not more than a half dram of the ointment daily. A course of potassium or sodium iodide is often useful, though here the greatest benefit perhaps is in its resorptive power. Systematic spinal drainage is sometimes employed but it should be born in mind that lumbar puncture may be contraindicated in brain tumor and in brain abscess.

DISEASES AND DISORDERS OF THE BRAIN.

EPIDEMIC ENCEPHALITIS.

In the light of further inquiry, the term of "lethargic encephalitis" has yielded to that of "epidemic encephalitis" since it has been abundantly shown that lethargy is a symptom in only one of several types of the present extensive epidemic of this disorder. Neither should the popular name of "sleeping sickness" be employed, even though pathologic sleep is

a frequent symptom, because this is the common name of a well known and usually fatal disease met with in Africa and which follows the bite of the tsetse fly.

Many of the clinical symptoms of epidemic encephalitis have been recorded for hundreds of years, so that the disease is by no means new, but by reason of the long periods between its recurrence, the affection appears new. The present epidemic was first brought to our attention by v. Economo, of Vienna, in 1917. Its bacteriological factor is uncertain and a number of organisms may be implicated, but in many instances the disease is found to be post-influenzal. Perhaps influenza or some other disease, or poison, may so reduce the resistance of the individual, that some unrecognized germ can then produce the encephalitis. It is thought that the germs may gain entrance to the body through the nose and throat, and sometimes the salivary glands are implicated, but certain it is that the virus has an especial affinity for the gray substance of the nervous system. Claim is made by Strauss and Loewe that they have isolated from the nasopharynx of patients, an organism yielding a filtrable virus, having some of the characteristics of the organism described by Flexner and Noguchi in poliomyelitis. One must bear in mind that occasionally in the past there have been encountered the symptoms of epidemic encephalitis which have resulted from poliomyelitis, syphilis, tuberculosis, alcoholism, food poisoning, pneumococcic infection, measles and other infectious diseases. The disorder must be regarded and dealt with as a probably communicable, infectious disease.

The many necropsies performed have tended to show that meningitis is a not very extensive finding, except as it involves the region of the interpeduncular space; often the peduncles, pons, medulla, cranial nerve nuclei and thalamus have been found the seat of punctate hemorrhages and edema; sometimes the pituitary is involved; further vascular changes in these areas and in the floor of the fourth ventricle are hyperemia, with perivascular infiltration and thrombosis of the small vessels.

It appears that epidemic encephalitis is most prevalent in March and April, and while no age is exempt, most cases

have developed between twenty and fifty years, with the male sex rather more commonly affected. Where a history of influenza has been obtainable, the disease has antedated the encephalitis sometimes by one month but more frequently by many months. Usually, the disorder is of abrupt onset, but occasionally it develops more slowly and it appears probable that many mild cases escape recognition.

The symptoms fall conveniently into two groups, those of the prodromal period and those of the established disease.

Prodromal Stage. Not infrequently, following an influenzal attack, the patient for several weeks may have felt perfectly well and may have resumed his duties, when slight blurring of vision is experienced and this perhaps is accompanied by ptosis or diplopia; to these may be added vertigo, gastrointestinal manifestations and frequently slight muscular unrest. After such symptoms have persisted for a time, the more definite illness declares itself.

Stage of the Established Disease. During this period the disorder will be found to conform more or less closely to one of several types, which usually run a course of from six weeks to several months, unless the disease is of the fulminating form, in which event it may prove rapidly fatal. Many patients tend to sleep more than is normal, but which, as regards depth, is not abnormal.

Lethargy. This is a frequent symptom but by no means a necessary one, as may be observed in patients who become maniacal when sleep may even be almost wanting. From this lethargy the patient can be aroused and his mind is usually found to be clear, but soon he relapses into a state of profound somnolency.

Facies. Often the patient lies expressionless and sometimes the face assumes a mask-like appearance similar to that of paralysis agitans. This facial change is probably due to some loss of expressional tone or to a bilateral weakness of the seventh nerve.

Temperature. Cases are reported without temperature, which, however, is not the rule and the range is usually from 99° to 103° F., while occasionally higher elevations are noted. Psychotic states are prone to a more or less continued tem-

perature and fatal cases run high. In a few instances a subnormal temperature has been noted.

Asthenia. Pronounced weakness is not always present but in grave forms of the disease it may be so marked as to prevent the patient from moving in bed. One must not regard the lethargic patient as necessarily asthenic.

Cranial Nerve Disturbance. Implication of the third nerve is most common. There may be ophthalmoplegia externa and interna, ptosis, interference of accommodation, nystagmus, and even optic neuritis. Other nerves that may be involved are the sixth, seventh, ninth, tenth, and twelfth.

Tremors. These are quite frequently encountered and they may be coarse or fine, and sometimes fibrillary twitchings are seen. In character they may resemble those observed in paralysis agitans, in multiple sclerosis or in paresis. Sometimes there are motor manifestations in the form of clonus, which may be unilateral or it may be localized, and in one case reported the clonus was confined to the rectus abdominalis muscle.

Sensation. Disturbances of this kind are not common except headache, though occasionally neuralgia is experienced or a burning sensation may be complained of.

Paralyses. Ocular palsies are frequent, while those of the extremities are only occasionally encountered. Hemiparesis may be seen and rarely there are Jacksonian seizures. Local atrophies have been observed.

Reflexes. The tendon reflex changes are varied and they may be increased, diminished or absent. Sometimes, in addition, the Babinski sign and ankle clonus are observed.

Mental Symptoms. Depression is the commonest mental manifestation but still, not infrequently, the mind is entirely clear. From the lethargic state the patient can easily be aroused but he soon lapses into his former drowsy condition. Emotional expression is often lacking. Occasionally there is encountered one of the more or less pronounced classic, psychotic types of disease.

Blood. Nothing worthy of mention is here seen except that rarely a moderate leucocytosis is met with.

Spinal Fluid. Often this is normal but not infrequently the pressure is increased. Occasionally there is a moderate

lymphocytosis and an increase in the globulin content. The sugar content is said to be usually increased.

Other symptoms observed have been disturbances of vision and audition. Then there may be a slow, nasal and often hesitant speech; vertigo, delirium, cerebellar ataxia, catalepsy, catatonia, peripheral neuritis, athetosis, sweating, hic-cough, and sometimes endocrine implication. Usually the patient is persistently constipated and quite frequently respiratory disturbances are associated.

While the complexion of the case may vary from time to time, and while the varieties may occasionally overlap, still, depending upon the part of the nervous system attacked by the inflammation, the disorder will usually be recognized as belonging to one of the following sub-groups: Lethargic, polioencephalitic, paralysis agitans, cataleptic, meningitic, myelitic, polyneuritic, or acute psychotic.

Lethargic Type. This is a common variety and results when the brunt of the inflammatory process falls upon the mid-brain, which forms the connection between the spinal cord and the higher cerebral regions, thus preventing impressions and stimuli from passing in from the outside world. Some attribute the lethargy to pituitary involvement, while others hold that it is due to a thalamic implication, and the latter is the more probable cause in most instances. The cause of the frequent cranial nerve implication in this type of the disorder is due to the presence of the various nerve tracts and nerve centers in this important region. Occasionally the lethargic state is preceded by a period of insomnia. The lack of facial expression is quite characteristic but is unlike the mask-like appearance of the paralysis agitans type.

Polioencephalitic Type. This group results from a rather low grade encephalitis in which there is involvement of one or more cranial nerves, the most frequent of these being the third, sixth, seventh, and twelfth, but the fourth, fifth, eighth, ninth, tenth, and eleventh, are occasionally implicated. Pupillary changes are common and retinal involvement may be seen. Other symptoms are asthenia, somnolence, vomiting, and dysphagia. In this group the disease process is largely confined to the mid-brain, pons, and medulla.

Paralysis Agitans Type. Several of the more prominent symptoms of Parkinson's disease may be present. There is the mask-like face, the fixed and bent attitude, the slow and monotonous speech, spasticity, and usually there is tremor at least during some period of the disorder. In this instance the disease is found resident in the lenticular nucleus.

Cataleptic Type. Before the patient becomes mentally unresponsive, vertigo may be complained of, and there may be ataxia and nystagmus. Soon an increased muscle tone develops so that the parts may be involuntarily sustained, for considerable time, in any position placed. Later, the patient lies motionless and in an inflexible rigidity. Sensation cannot be investigated but the reflexes, so far as they may be studied, are usually found to be normal. Here, the cerebellum shows the brunt of the disease.

Meningitic Type. This form is by no means common though some of its symptoms may be met with in other types. The manifestations to be looked for are irritability, headache, photophobia, delirium, rigidity of the neck, Kernig's sign, and tache cérébrale.

Myelitic Type. Reflex changes are common and response may be entirely wanting. Sometimes there are twitchings in the extremities, and there may be the Babinski sign, ankle and knee clonus and even clonus of the arm. The sensory manifestations are pain and numbness in the extremities and about the chest. Bladder and rectal implication is frequent. Occasionally there may be seen a sub-group of the polio-myelitic type. In the myelitic form the disease is of course, for the most part, in the spinal cord.

Polyneuritic Type. While this is not so common, an irregular form may yield pain, paresthesia and other sensory disturbance in the extremities. General symptoms are anorexia, insomnia, tachycardia, epistaxis, loss in weight, elevation of temperature, hiccough, and perspiratory and lachrymal activity.

Acute Psychotic Type. It is a well known, though curious fact, that acute affections may lessen the manifestations of a chronic insanity, or for a time even hold them in abeyance, but an actual restoration is so rare that when it occurs, the question naturally arises as to whether the restoration has

not resulted from some other cause. On the other hand, preëxisting psychoses may be aggravated by epidemic encephalitis and paresis and dementia precox may be precipitated by the disease. Hallucinations, illusions, delirium, confusion and depression may be encountered without there being a frank psychosis. Depression is the condition most frequently met with. A fairly clean-cut manic-depressive case usually makes a good recovery, but when the depression is a part of a developing dementia precox, the prognosis is not nearly so good.

Important differentiations to be made are those of acute poliomyelitis and tuberculous meningitis. In the latter, signs of distinct meningeal involvement are very suggestive. Mild and abortive cases are rather common though usually not serious, but the mixed forms may at times be rather confusing.

In duration, the disease lasts from six weeks upwards, and following this an asthenia may persist for many months. The mortality is from twenty per cent. to twenty-five per cent.

Treatment. No measures of a specific nature have yet been found. Absolute rest of mind and body are essential, and careful feeding and nursing are required. An occasional lumbar puncture sometimes affords relief and this may facilitate the action of urotropin, which is so often administered internally. A diminished heart and respiratory action require support. Pronounced insomnia should be met by the administration of adalin and medinal; restlessness, with bromides, perhaps morphin and scopolamin; and delirium, with sponging. Marked agitation may be benefited by hyoscin, and special features of the different cases must be disposed of as they arise.

APOPLEXIES.

There is an erroneous belief regarding apoplexy, since it is not necessarily due to rupture of a blood-vessel but it may also result, and usually does, from thrombosis, embolism, or arterial spasm. Bearing this in mind one may meet with the disorder at any age, but most frequently it occurs in middle life, particularly between forty and fifty, with the

male sex predominating. Strictly speaking, an apoplectic attack implies the sudden loss of consciousness with a fall; but the term is employed in a larger sense so that it includes less severe and more varied manifestations.

Thrombosis. This condition results most frequently from a syphilitic arteritis, though it may also be due to such causes as lead poisoning, gout, and diseases of the blood. If the lumen of a vessel becomes completely blocked, degeneration and softening may occur and finally result in a small scar or a cyst. The offending thrombus usually develops slowly so that the symptoms are less precipitate than in other conditions. Such prodromes as headache, vertigo, and drowsiness, may be experienced, together with transient paralyses, muscular twitchings, and even convulsions. The drowsiness sometimes deepens into coma. If a hemiplegia develops, it differs in no wise from that of other origin except in its more frequent recovery. Depending upon the site of the lesion, such special symptoms as aphasia, hemianopsia and astereognosis may appear.

Embolism. The sudden blocking of a vessel by an embolus is likely to occur somewhat earlier in life than is a thrombus formation. The condition usually results from endocarditis, infections, pregnancy, malaria, or grave anemia. The pathologic picture is much the same as in thrombosis, and the symptoms also are similar, with the exception that they usually develop much more abruptly.

Cerebral Hemorrhage. The conditions operative in middle life are not so conducive to cerebral hemorrhage except in the matter of trauma. However, late in middle life an arteriosclerotic process may be well advanced, so that a sudden increase in blood-pressure as produced by heavy lifting, straining, or coitus, may result in the rupture of a blood-vessel. Usually, it is the branches of the middle cerebral artery that are implicated and the site of hemorrhage is for the most part in the internal capsule, lenticular nucleus, optic thalamus, or caudate nucleus, though cortical hemorrhage, while not so severe, is not so infrequent. Often there are prodromal symptoms but the coma appears suddenly; there is flushing of the face, the pupils are sometimes unequal, the breathing is stertorous, the extremities are cold and at first completely

relaxed; often there is conjugate deviation of the eyes; the reflexes are absent, and sometimes the sphincters are incontinent. If the hemorrhage is extensive and happens to break into the ventricles, death usually is only a matter of hours; the common types of paralysis are, arm and leg; arm, leg, face, and perhaps tongue, and sometimes with aphasia or sensory manifestations. When the hemorrhage is from a meningeal vessel, there is often present the irritative Jacksonian symptom and this is a much less serious condition than is hemorrhage into the brain. Hemorrhage may also occur in the crus cerebri, the pons, or the cerebellum. Implication of the posterior cerebral artery yields the syndrome of Benedict with its resulting oculomotor paralysis on the same side, and with tremor, choreiform movements and paralysis of the extremities on the opposite side. Involvement of the posterior inferior cerebellar artery sometimes occurs; here, consciousness may be disturbed but it is seldom lost; often there is paralysis of the muscles of deglutition, the soft palate, and of the vocal cords; disturbance of sensation in the fifth nerve distribution, cervical sympathetic involvement and ataxia of the extremities on the same side; on the opposite side there may be ataxia, paresis, and loss of sensation.

In severe cases with implication of the middle cerebral artery which are not fatal, the patient is usually left with a residual condition, and this may be considered to be present about a month after the onset. The improvement made is most apparent in the tongue and face, next in the leg, and least of all in the arm. There is less return of power in the distal ends of the extremities than in their proximal parts. The affected side is spastic, the tendon reflexes are exaggerated, and clonus and the Babinski sign may be present. Changes in mentality may be noted; the patient may be irritable, emotional, sometimes shows failure of memory, and a right hemiplegia may be attended by an aphasia.

A late traumatic apoplexy is recognized and is recorded in medicolegal annals. It is said the period of a month may intervene between the head trauma and the apoplexy, and in one instance it was claimed that it did not occur until a

year after. Probably through concussion the vessels are injured and subsequently thrombosis or rupture results.

Sometimes differentiation is necessary from the unconsciousness of hysteria, epilepsy, alcoholism, opium poisoning, diabetes, and uremia. As regards life, prognosis is usually good except when there is hemorrhage into the ventricles, the pons, or the cerebellum.

Treatment. If seen immediately after an attack, elevate the patient's head and apply an ice-cap. Venesection may be dangerous but at times it is useful where the hemorrhage has occurred in an individual who was previously known to have hypertension. Manual pressure over the carotids should be judiciously employed, the blood directed toward the extremities and active purgation brought about. However, if it is believed that the condition has resulted from thrombus formation, such active measures should not be applied as they would prove harmful. Drugs must be used cautiously unless syphilis is an active factor. If trauma is suspected surgical intervention may be required. Cushing has operated for the removal of a blood-clot where the blood-pressure was high. Such intervention has even afforded relief as a decompressive measure. Later, massage, exercises and mechanical support should be employed.

THE APHASIAS.

Aphasia is a disturbance or a loss (1) of the ability to express one's self in speech, writing, or otherwise; or (2) of the understanding of language written, spoken, or of information otherwise conveyed. A combination of both may be present and in fact a definite and separate motor or sensory aphasia is clinically, scarcely possible. This disorder is resident in the cortical areas or their connecting tracts and is not in the special organs or in the peripheral nerves. Aphasia, in right-handed persons, is due to disturbance of the left cerebral cortex or its associated paths, and is usually (1) organic, when it may be due to tumor, hemorrhage, encephalitis, thrombosis, embolism, and acute edema; (2) functional and usually transient, as in hysteria, epilepsy, arterial spasm, anger or fright, and in such toxic states as uremia, diabetes, alcoholism, or that due to other poisons.

Certain clinical types are recognized though they are not clearly cut.

Motor Aphasia. This results from involvement of Broca's zone and some of the surrounding areas and their associated pathways. The patient is more or less incapacitated in his speech or in his writing. Cortical motor aphasia yields a defect in silent reading or in writing. Subcortical motor aphasia, which is the more common, shows an incapacity to speak, to read aloud, or to repeat what has been said; spoken words or written signs are usually understood but writing is not often possible.

Sensory Aphasia. This is an inability to properly recognize spoken words or written symbols, and is divided into auditory aphasia and visual aphasia.

Auditory aphasia, which is also spoken of as word-deafness, is produced by a lesion in the upper surface of the temporal lobe. It is an inability to properly appreciate sounds though they are distinctly heard. Cortical auditory aphasia shows implication of spontaneous speech, either in talking or in reading aloud. The patient cannot repeat or write from dictation and he may be more or less unconscious of his defect. Subcortical auditory aphasia is due to a block in the tracts below the auditory area and here the individual is unable to understand spoken words, or to repeat or to write from dictation.

Visual aphasia, which is also called alexia or word-blindness, is due to involvement of the angular gyrus. It shows an inability to comprehend what is seen. Cortical visual aphasia shows a preservation of volitional speech but it renders the patient unable to read aloud or to himself. He cannot copy, write spontaneously nor from dictation. Subcortical visual aphasia is due to a block in the paths below the visual area and is frequently accompanied by hemianopsia. The patient cannot understand written words, even his own; he cannot read aloud, but he may write from dictation.

The prognosis in sensory aphasia is somewhat better than in motor aphasia. The patient may be more or less re-educated by special methods. Some forms of aphasia are spontaneously restored.

TUMORS.

Growths in the brain and its appendages are more frequent, though less operable, than are those of the spinal cord. After late middle life they are not common. The more usual tumors are the glioma, endothelioma, neurofibroma, tuberculoma, syphiloma, sarcoma and carcinoma. The rarer forms are fibroma, osteoma, angioma, lipoma, psammoma, cholesteatoma, circumscribed serous meningitis, actinomycotic and echinococcic. The causes of primary tumors of the brain are for the most part uncertain except the syphilitic, the tuberculous, the aneurismal and the paralytic. A few are developmental anomalies and trauma is a doubtful etiological factor.

The symptoms are divided into general and focal, either of which may appear first. The general symptoms are in the main caused by an increase of intracranial pressure because of the confinement of the fluid within the rigid adult skull. These symptoms vary with the growth of the tumor; they are more pronounced when the neoplasm is in the posterior fossa and they are not of much localizing, diagnostic value. While the general symptoms vary from time to time and may even disappear, on the whole, they are progressive.

Headache. This is the most common symptom and is due to a stretching of the fibers of the fifth nerve or to their actual implication in the growth. The site of the headache is by no means necessarily indicative of a tumor in the corresponding region. The intensity varies but it is usually quite severe, especially if the growth is in the posterior fossa. Physical strain and emotional excitement aggravate the symptom, while, on the other hand, the distress may cease for a time. Occasionally, the sensation is one of pressure or tightness.

Mental Changes. These are especially pronounced in tumors of the frontal lobes. There is dullness, irritability, somnolence, lapses of memory, and the individual may lose his way, show foolish attempts at humor, there may be a lack of moral sense, and he may even become delirious. Maniacal outbreaks may occur, later a pseudo-dementia, and

eventually a comatose state. The foolish acts of the patient may at first lead one to believe that the disorder is hysteria.

Papilledema and Optic Atrophy. Papilledema or choked disc is an exceedingly frequent sign and results from the intracranial pressure forcing the cerebrospinal fluid along the optic nerve sheath. It is usually bilateral, though often of unequal intensity. Reversal and interlacing of the visual field has been insisted upon by Cushing as an important finding, but the sign is seldom available early. Other occasional eye symptoms are nystagmus and diplopia.

Convulsions. These seizures are common, are general in character, and may persist irregularly during the progress of the growth, with death frequently occurring in a convulsion.

Nausea, Vomiting, and Dizziness. These manifestations appear rather late. The vomiting, which may be forcible, often occurs spontaneously, though it may be absent even in growths of large size.

Other varied symptoms are a pulse which is at times slow and which sometimes shows arrhythmia. Respiratory disturbances, in the form of hiccough and yawning, may occur and Cheyne-Stokes breathing may be present. Metabolic disorders have been known to arise. A carcinoma yields a cachexia and marasmus. Tumors of the pituitary sometimes show ovarian and testicular aplasia, adiposity, perhaps acromegalic tendencies, and in the female, amenorrhea.

Focal symptoms depend largely upon the site of the growth, and, if it is the "silent areas" of the brain that are invaded, they may even be absent.

Tumors of the Frontal Lobes. Involvement of this region of the brain often yields changes in the higher psychic sphere so that there may be shown impairment of memory, irritability, poor concentration, and foolish tendencies. Vertigo, a staggering gait, and a disturbance of the sense of smell, may be present. If the tumor is in the left hemisphere, perhaps aphasic manifestations will appear. Sometimes the motor signs of stiffness of the neck muscles, tremor of the hands, and Jacksonian spasms, are encountered.

Tumors of the Motor Area. Irritative manifestations are numerous in this region. Lesions of the cortex usually cause spasms and convulsions, while those of the deeper parts

generally lead to paresis, or paralysis. Psychic manifestations are not common but sensory symptoms may be present. In right-handed persons, involvement of the left motor area often leads to disturbances of speech. Growths here show marked localizing signs and so lend themselves rather readily to operation.

Tumors of the Parietal Lobes. Disturbances of sensation and muscle sense are often present together with stereognostic changes. Word-blindness and homonymous hemianopsia may be encountered, and sometimes there are conjugate movements of the eyes to the opposite side.

Tumors of the Temporal Lobes. These are often difficult of recognition. If in the left hemisphere there may be word-deafness. Occasional uncinatè fits are present—aura of taste, chewing movements, and a peculiar dreamy state. When the optic thalamus is pressed upon, emotional expression may be interfered with and hemianopsia likewise may be produced.

Tumors of the Occipital Region. Complete homonymous hemianopsia and visual hallucinations are quite common. Mind-blindness may be present and there may be additional symptoms through implication of adjacent parts brought about by pressure.

Tumors of the Optic Thalamus. Hemianesthesia, spontaneous pain, and choreic movements, may be observed. Hemianopsia, mental dullness, and causeless laughing, occur but are less common.

Tumors of the Crus. These show third nerve paralysis on the same side and hemiplegia on the opposite side.

Tumors of the Pons. Early recognition is here often possible by reason of the many focal points present. If the growth is in the upper part, the symptoms are the same as in the preceding site. If lower down, there may be caused hemiplegia and sensory paralysis of the opposite side, together with involvement of the sensory fifth, sixth, seventh, or eighth nerves; also, there may be forced movements and conjugate deviation of the eyes.

Tumors at the Base of the Brain. Implication of the Gasserian ganglion causes excruciating pain with disturbance of sensation in the part supplied and sometimes with involvement of other cranial nerves. Tumors of the pituitary may

lead to acromegalic symptoms, adiposity, mental dullness, somnolence, amenorrhea, and asexualism; there may also be hemianopsia, optic atrophy, and convulsions.

Tumors of the Cerebellum. Symptoms vary with the site of the growth. The general manifestations are headache, vomiting, vertigo, papilledema, and optic atrophy. Hydrocephalus is common. The gait is quite characteristic. Then there may be asynergia, ataxia, adiadokokinesis, hypotonia, and nystagmus.

Tumors of the Medulla Oblongata. Here, a large growth would cause marked paralysis of motion and sensation, most probably, bilateral. The symptoms of progressive bulbar palsy might be produced and there would be cardiac and respiratory arrhythmia.

Diagnosis. The diseases most likely to require differentiation from brain tumor are paresis, brain abscess, tuberculous meningitis, chronic hydrocephalus, multiple sclerosis, and hysteria. X-ray studies should be made and a small cylinder of tissue from the brain site has been successfully removed for microscopic sections.

Lumbar puncture, it must be borne in mind, is at times dangerous and this is especially true of growths in the posterior fossa.

Prognosis. A syphiloma may yield to vigorous medication, although usually the outcome is not so favorable, and a few tumors can be successfully removed. Death, which often occurs suddenly, frequently supervenes by the third year.

Treatment. When the growth is due to syphilis, persistent antisyphilitic medication must be carried out. For the inoperable tumors, a decompression relieves the headache and often improves the vision.

DELIRIUM, CONFUSION, AND STUPOR.

Delirium is a condition which occasionally attends the administration of certain drugs, it also accompanies various diseases and sometimes it follows trauma. One group of drugs, such as cannabis indica, hyoscyamus, and belladonna, is known as delirifacients. The bromides, cocain, opium, together with the true hypnotics, may also cause this state to develop. Infections, exhaustion states, alcoholic and lead

poisoning, one stage of major epilepsy, certain operations (notably upon the external genitalia and the bladder), and trauma (especially of the head), all may lead to the disorder. Finally, there is a fulminating psychosis known as acute delirium.

A delirium is caused by cerebral excitation, the essential features of which are illusions, hallucinations, fleeting delusions, incoherence, confusion, with motor restlessness, though sometimes the patient lies quietly, and the state is commonly but not necessarily attended by fever as, for instance, in delirium tremens. In duration it is short, lasting from a few hours to possibly two weeks. Delirium occurs more frequently in private practice and in general hospitals than in hospitals for mental diseases. This condition may precede the active manifestations of an infection, it may occur during the course of the disease, or it may follow the disease. In the last instance the delirium is a part of an exhaustion state. It is a frequent accompaniment of certain diseases. In typhoid fever delirium is usually of the low muttering type, but occasionally, owing to a greater cerebral irritation, it is more active. However, much of this disturbance has been obviated through the cold water treatment. Delirium often develops early in pneumonia, and usually shows visual and auditory hallucinations, with confusion as a rather frequent manifestation. Erysipelas with face and scalp involvement is most likely to develop the condition. Sometimes a traumatic delirium appears independently of an alcoholic intoxication. Burns and scalds of the head and face, and intracranial injuries frequently show this state. Some persons have such an idiosyncrasy that any severe pain is likely to be attended by delirium.

Acute Delirium. This disease, which is also called Bell's delirium and typhomania, is characterized by delirium, fever, great motor restlessness, rapid and extreme exhaustion, and frequently terminates in death. Some writers deny its existence as a separate entity, but the symptom complex at least is seen, since it may accompany typhus fever, tuberculosis, cancer, influenza, and dysentery. Cases of unknown origin are believed to be due to some specific infection, and a recent explanation of the psychosis is rapid adrenal break-

down. Most attacks develop in middle life, with females perhaps the more frequently affected. It is one of the rarest of the psychoses. The average duration is from ten days to three weeks, and it is estimated that from one-half to three-fourths of those afflicted die. A fatal issue may come as soon as the third day. Prodromal symptoms are insomnia, depression, hallucinations, a clouding of consciousness, and disorientation. The patient passes into the stage of violent delirium and becomes rapidly exhausted. He is wildly frenzied, tears about the room and throws himself against the walls or attacks those who come near him. If restrained, he tugs frantically at his fastenings. Annoying paresthesias are experienced and delusions of persecution present themselves. He refuses food and wastes rapidly. Often the reflexes are increased, the expression is anxious, and the body becomes pale and shrunken. The lips are parched and cracked, the tongue dry and covered with a heavy brownish coat. The patient is constipated, the fever ranges from 102° to 106° F., and now, being too weak to sustain the struggle, he passes rapidly into stupor, followed by profound unconsciousness and death, frequently from hypostatic congestion of the lungs.

The *diagnosis* rests upon the fever, delirium, the rapid course, the early exhaustion and high mortality.

Treatment of mild forms of delirium consists in the free use of liquids, packs, and baths. The patient should have nutritious food, stimulants and sedatives such as medinal, sulphonal or luminal. In Bell's delirium, restraint in a warm immersion bath is most useful and artificial feeding is often necessary. Stimulation must be actively employed.

Confusion. In this condition various synonymous terms are used, such as acute hallucinatory confusion, confusional insanity and amentia. The symptoms are more mild and usually of longer duration than are those of delirium. The characteristics of confusion are, a clouding of consciousness, incoherence, fleeting hallucinations, perhaps with delusions and emotional changes, and with only a mild degree of motor unrest. Essentially, the disorder consists in the dissociation of ideas and a failure to properly recognize external objects. Like delirium, it may result from infections, intoxications,

prolonged use of hypnotics, trauma, and exhaustion. Confusion may occur in connection with hysteria, before or after epileptic seizures, in a number of the psychoses, possibly even in paresis and paranoia, and sometimes in focal brain diseases. Prodromal symptoms are, insomnia, restlessness, nervousness, and with some failure of memory. Gradually the patient becomes more and more disoriented as to time and place. It is only by great effort that the attention can be held. There are hallucinations and apprehensiveness. The patient often wanders about the room, or if in bed tries to get out, though occasionally he will lie quietly. The appetite weakens and nutrition is impaired. Finally after some time, a change is gradually brought about, the patient gains a little in strength, the nutrition improves, consciousness returns at first for brief periods until fully regained. Confusion may last for a few weeks or for some months, and it is but seldom fatal unless accompanied by some serious organic disease.

Treatment. The nursing and sick-room care is important. If exhaustion is at all pronounced, the patient should be kept in bed and be given massage. Restlessness does not require the active combating that does the struggling of delirium. Sometimes the patient will not eat, so that feeding will have to be forced. Medicinal treatment should be supportive and tonic. In a protracted case, the expense may necessitate the installation of the patient in a detention hospital.

Stupor. In addition to stupor, the terms stuporous insanity, and acute curable dementia, are sometimes used. Delirium and confusion may, and often do, precede stupor, and stupor in turn may deepen into coma. There is an important distinction—in stupor the patient can be partly aroused, but this is not true in coma, so that the latter is much the more serious state. The condition of stupor may be encountered under various circumstances. It may follow alcoholism and is seen in status epilepticus. A stuporous form of melancholia is recognized in which, however, the obtundity is not so pronounced as in some other diseases; here, the patient who has sunk into the depths of despair seems entirely oblivious to his surroundings and he cannot make the necessary effort to arouse himself.

Stupor may result from infections and intoxications. It may also be due to brain exhaustion, mental shock, or it may result from trauma to the head. The condition, except when due to shock, develops slowly and often is preceded by confusion. Gradually, the patient becomes less and less aware of his surroundings until finally he is almost oblivious. He lies expressionless and when addressed is but slightly responsive. The tendon reflexes are often increased, the pupils are usually dilated and react sluggishly to light. Pain and tactile sensations appear lost, which however is not due to an actual anesthesia, but rather to the mental obtundity. The muscle tone is lessened and there is lowered vasomotor tone so that the extremities may be cold, cyanotic, and even edematous. If the patient does not take sufficient food to sustain life, one becomes obliged to employ forced feeding. At times the loss in weight is most remarkable. The disorder may last for some months, with perhaps occasional brief lucid periods. Then the patient gradually gains in strength, he becomes more observant, and begins to talk a little, but complete restoration is always a matter of considerable time. When trauma is suspected, the head should be carefully examined for external injuries, for blood or other fluid in the external cavities, for hemorrhage under the scalp; the eyes and the extremities studied for localizing signs, and an x-ray examination should be made.

Treatment. Medicinal remedies should be supportive and tonic. Forced feeding may be required. Massage and packs are very useful. Depending upon the etiology, some special forms of treatment may be required, and surgical intervention is occasionally necessary.

HYPOCHONDRIA.

A perplexing problem is sometimes presented by patients who believe they suffer from a definite disorder, and for which the physician can discern little or no foundation. As a syndrome the condition may be encountered in such diseases as melancholia, neurasthenia, psychasthenia, hysteria, dementia precox, paranoia, and early paresis. But occasionally there exists sufficient evidence to convince one that the

disorder develops independently of other diseases and for this affection the term hypochondria is employed.

Somatic impressions, which are being continuously received by the brain centers, constitute the cenesthetic sense but in health we are not aware of such sensations. Either hyperesthetic brain centers or indiscernable somatic conditions give rise to the abnormal sensations of the hypochondriac. More commonly the disease appears in men who are unmarried and whose work is sedentary, but no occupation or station in life is exempt. Successful business men who retire from active work in middle life are sometimes its victims.

Hypochondria is temperamental* and such an individual may become introspective, finally settling upon some part of his body as the seat of an imaginary disease and over which condition he proceeds to brood. He may worry over having masturbated, he may believe that his bowel is blocked, and again it may be syphilophobia or phthisophobia that is slowly undermining him. He talks constantly of his ailment, likes to be examined and so visits many physicians and cults. He is prone to become an enthusiast in matters of exercise, diet, the amount or kind of clothing required, and as to bathing, seems at times to forget that man is a land animal. The disorder often lasts for years, subject to fluctuation, during which period the hypochondriac may appear in fair health. Mental deterioration does not occur and the patient is not so apt to commit suicide as is one suffering from melancholia, though sometimes an attempt is made, to elicit sympathy.

The disease may recur in certain families, and where children are inclined to be morbid and introspective they should be trained out of such tendencies by having their home surroundings and associations as wholesome as possible. The hypochondriac should not be permitted among invalids, since such contact often leads him to believe he has the same disease.

Since hypochondria is temperamental, alcoholic stimulants should not be prescribed. Medicines are of little value except in the matter of suggestion and for this purpose a large capsule containing starch may be administered. The physical

measures of massage, hydrotherapy, and electricity, may be helpful. Occasionally, it happens that a hypochondriac through worry becomes debilitated and even exhausted, when, either a rest cure or modified rest should be instituted. But usually the individual is not badly off and needs mental occupation, so that often his best interest is served by directing him to an active out-of-door life with the cultivation of some fad.

MANIC-DEPRESSIVE PSYCHOSIS.

The various types of mental disorders included under this heading seldom occur before adult life. Formerly, mania and melancholia were considered separately and for the most part were regarded as curable. It had long been known that another group of patients who showed both conditions were not nearly so hopeful as to the ultimate outcome and these were often described as cases of circular insanity. Finally, Kraepelin, from an exhaustive study of the life histories of many cases of mania and melancholia, was able to show that an excited and a depressed phase was likely to be encountered in each of these individuals, that these phases were prone to recur, and so he included the entire group under the comprehensive title of manic-depressive insanity, which term has been almost universally adopted. However, Kraepelin's studies were largely those of asylum cases, which are necessarily more severe than the group of psychoses commonly accorded extramural care. Therefore, in private practice, patients are sometimes encountered with hypomania or mild melancholia which do not conform to this alternating type of insanity, since these psychoses may remain as solitary attacks. A faulty heredity is back of nearly all cases of manic-depressive insanity, though it has not necessarily manifested itself as the same type of disorder.

The manic phase of this disease when well developed, is characterized by emotional exaltation, a rapid flow of ideas, and by psychomotor agitation. In the beginning there are prodromal symptoms which may precede the actual outbreak from a few days to several weeks. The individual may show insomnia, anorexia, constipation, restlessness, ineptitude for work, apprehensiveness, headache, cephalic paresthesias,

brooding or hypochondriasis, and loss in weight. But later a change comes over the personality of the individual and he passes into the state of hypomania. Now he becomes energetic and lively, has a general feeling of well being, emotional activity appears and every undertaking is overdone. His movements are hurried, he talks rapidly and sometimes incessantly. He is conceited, self-assertive, he unfolds his many plans and unbosoms himself to utter strangers. He is jocular, is angered without cause, and immoderation is shown in every action. A not uncommon feature of this state is excessive alcoholic indulgence, which debauchery may last for weeks, and this condition constitutes the so-called periodic drinking. Another and even more unfortunate occurrence is eroticism, so that sexual indulgence may be practiced to a shameful extent, which, when appearing in a woman seems especially disgraceful and may be fraught with disastrous consequences. The whole state may end only in hypomania or it may advance to a graver form of the psychosis.

Acute Mania. Here, the disorder has progressed to a state characterized by incoherence, clouding of consciousness, perhaps some disorientation, later with delusions which are often expansive, and occasionally with illusions and hallucinations. Physical and mental agitation increases. There is a rapid flight of ideas but the patient is easily distracted. He mistakes those about him and a moment later identifies them as still other persons. Long recitations, sometimes of poems, are rendered. He shouts, yells, runs and jumps, and tears to pieces clothing and furniture. God and the heavenly angels may be seen, though they only appear momentarily. In this state of frenzy, which may last for days or possibly for months, the patient sometimes eats but little, consequently, emaciation is not infrequent. In other instances the body weight is maintained or possibly the patient may fatten. For the most part this mental excitement subsides gradually but sometimes a grave state of delirium develops and this is termed hypermania.

Hypermania. Here, one sees the extreme of the condition and injuries from violence in this exhausted state occasionally lead to suppuration and possibly general infection, so that

to the symptoms of acute mania may be added those of delirium. In this violent state it may not be possible to give patients the best of attention, nor can they always be properly examined physically, so that for a time their exact condition may be overlooked, and an unfortunate, fatal kidney or lung disease develop.

Depressive Period. Temporary depression is the natural expression consequent upon misfortune or other distressing circumstance, but where depression becomes chronic, or where it appears without adequate cause, the state assumes pathologic significance. Such a mood may develop into a melancholia or it may precede other psychoses, and the most common factors that make for this disorder are tainted heredity, poor health, and mental strain. The course of melancholia may be acute, subacute, or chronic, and in point of age it is most frequently encountered between twenty and thirty, and at the climacteric. Recognized types are, simple melancholia, delusional melancholia either with or without agitation, sometimes showing a pronounced religious trend, and another form which displays more or less stupor.

The most important type of depression is that which occurs as a phase of the manic-depressive psychosis, and as such is characterized by emotional depression, retarded cerebration, and psychomotor inhibition. In addition to despondency there is a slowing of the process of thought, usually the patient talks but little, often in a low voice, and sometimes in monosyllables. There is a disinclination to associate with others, and a feeling of inadequacy together with a general neglect of duty in every respect. A few patients develop illusions and hallucinations and when these are extensive they constitute a sub-group known as hallucinatory melancholia. Others show a marked religious coloring with the delusion of unpardonable sin, leading to eternal damnation, as a frequent symptom. Some patients are incessant in the outpouring of their mental distress, while others may remain mute for a long time. The mental state is always reflected in the face and this sometimes speaks of utter despondency. Where agitation is a marked feature, the skin may become raw from constant rubbing, tufts of hair may be pulled out, and even the body may be mutilated. The

secretions are usually decreased, the tongue coated, anorexia and constipation are usually present, and the blood-pressure may show hypertension. Suicide is always a possibility and, in the delusional form, must be especially guarded against.

The stuporous group show the extreme of the depressive period. Here the patient may sit or lie almost without moving and may remain mute for many months at a time. Forcible feeding may be necessary, the bowels moved by means of an enema, and catheterization regularly performed. Occasionally the condition of catalepsy supervenes. The temperature is subnormal, the circulation is feeble, and the loss of weight may be extreme.

Periodicity is sometimes so pronounced as to render it possible for the patient, and even those about him, to foretell the oncoming attack by reason of some slight change in manner or action. Some periodic attacks have been spoken of as recurrent and intermittent mania or melancholia, circular insanity, and alternating insanity. Insanity of the circular type may vary somewhat as, for instance, the uninterrupted and repeated cycle of melancholia and mania, or there may be an interval of normal mentality between these phases. Such cycles vary vastly in point of time—they may be completed in from two days to many months. The melancholic phase is frequently the longer of the two.

Involutional melancholia is a term used to designate those types of depression occurring in women at about the menopause—between forty and fifty years—and also the depressed states occurring in men, but here manifesting themselves at a rather later period. The condition is not unlike that of the melancholic phase of manic-depressive insanity.

The manic phase may require some differentiation from those cases of paresis beginning with excitement. The phase of depression should not be mistaken for neurasthenia, psychasthenia, or paresis.

The *prognosis* of an existing attack of manic-depressive psychosis is favorable, but recurrence is frequently encountered. Insanity of the circular type is somewhat less promising, and involutional melancholia likewise shows a less frequent complete restoration.

Treatment in the excited stage must vary with the extent of the disorder. Hypomania may be treated at home or given care elsewhere, outside of an institution. In the more noisy and violent forms the patient may be so objectionable as to render institutional detention imperative. The out-of-door treatment is highly endorsed by some. Hydrotherapy is most quieting and the patient may be sponged between blankets or be given wet packs. Those showing extreme excitement are often most successfully treated by means of the continuous baths or such baths may be given intermittently. Such a procedure often does away with the necessity for powerful hypnotics. The nutrition must be maintained by careful feeding, possibly by forcible feeding. Drugs used for their sedative and hypnotic effects are, adalin, medinal, sulphonal, luminal, and perhaps hyoscin and morphin. Owing to the violence of some patients, the protective measure of mechanical restraint may be desirable.

In the treatment of the depressed stage, and where there is a profound suicidal tendency, a hospital of detention may be preferable; however, among the well-to-do, where every possible safeguard may be thrown about the patient, this is not so imperative. Severe cases do well under the full rest régime, while milder ones may be cared for with modified rest treatment. Laxatives, stomachics, reconstructive tonics, and sedatives, are sometimes required. Occasionally, thyroid preparations in moderate doses are helpful. A nutritive and easily assimilable diet should be given, and where the patient persistently refuses to eat, forced nasal feeding must be resorted to. Later, light exercise and a change of scene can be advised. Alcoholic stimulants should be avoided. In the stuporous state the position of the body should be changed from time to time, and enemata and catheterization are sometimes necessary.

PARANOIA.

The term paranoia has been used since ancient times, though its application has undergone much change and at present is employed in different ways by various writers, but always in a much more restricted sense than formerly. In a general way the disease may be said to be a slowly

developing and chronic psychosis, with the gradual unfolding of delusions, often of persecution, unyielding in character, but in which the intellectual processes are otherwise well preserved, though mental deterioration sometimes results in the late stage. The deranged thoughts sometimes tend more or less in one direction, so that a former synonym was monomania, but often this does not hold true and the term has fallen into disuse.

Paranoia is not a common form of insanity, since it seldom occurs oftener than once among two hundred admissions into our large asylums. But the nature of the disorder, frequently with delusions of persecution, with threatened and sometimes actual litigation, and occasionally with murderous assaults upon the believed persecutors, has kept the disease prominently before the public, so that it appears a rather common one.

For the most part paranoia develops in middle life, and those individuals who have shown somewhat similar symptoms at an earlier period, probably have had an aberrant form of dementia precox or have been alcoholic, syphilitic, or epileptic subjects. The disease is more common among men. Hereditary influence is difficult to trace, but so much history as has been obtained points to the rather frequent occurrence of mental diseases in the ancestry. In times of great stress, such as wars, there always come to public notice a few of these insane persons. As to the individual, he appears often to have been regarded as a bit different from other children, which variations may have shown some accentuation at puberty. Later, there may have appeared some unusual ambition; suspiciousness, stubbornness, untrustworthiness, or general weakness of personality, may have been observed, so that psychopathic tendencies earlier in life have probably been present. Environment appears to have little if any bearing upon the disease. Paranoia is an endogenous and primary affection of the intellect which in its development is almost imperceptible.

The course of a typical case of paranoia has been conveniently divided by Ziehen into four stages: Prodromal, persecutory, expansive, and pseudo-demented. In the prodromal stage the individual may be employed at his business,

but he becomes preoccupied and introspective. Sometimes peculiar paresthesias are experienced in the extremities, body, and viscera, and other neurasthenic symptoms manifest themselves. He may be, and often is, hypochondriacal. Perhaps he is conscious of the difference between himself and others, which he seeks to explain by special inquiry into his condition. Failing in this way to find an adequate explanation for his discomfort, he begins to wonder if some outside influence may not be at the bottom of his various annoyances. Soon his duties are neglected and he becomes more or less distrustful of those about him, believing himself to be the object of their special attention. Finally, it becomes clear to his associates that there have actually developed in him some peculiar traits of character. Unusual noises and sounds are heard, to which he at first gives strange interpretations, but which later become well marked hallucinations.

Now there gradually appears the persecutory period, in which the individual has arrived at the definite conclusion that scheming and plotting is being carried on against him—he is the victim of a conspiracy—though as yet he does not identify his persecutors. Often he believes scandal is being spread about him. People at a distance are engaged in conversation concerning him, though he may be so far away as to render it impossible to hear their voices. The paranoiac is thoroughly modern in his hallucinatory experiences. Formerly, the machinations of his enemies were directed at him through telegraph wires, then the telephone was employed as a means of torturing him, and now it is the wireless system that flashes the damnatory messages. Electricity is shot into his body and x-ray machines are used to read his thoughts. Often his food is poisoned and poisonous gases are being directed toward him. Since he has now worked out elaborate details, the plot against him is complete. At times the persecution comes from a single individual, but more frequently it is some religious body, some political or fraternal organization that is attempting to ensnare him in its toils, so that it may be the Jesuits, Protestants, Masons, or Socialists, that are conducting this nefarious propaganda against him. By this time he begins to enter complaints, though they may not be made directly or openly to those

engaged in the conspiracy. Anybody may be complained to or the local authorities may be apprised of the crime, and sometimes an astonishing amount of credence is at first given to his charges. Failing to get the necessary local protection, the Governor may be communicated with and finally an appeal may be made to the President, either through the mail or in some instances by attempting a personal interview. In the meantime the paranoiac may appear in good health and may be moving about his community without attracting attention. Sometimes he attempts to defeat his persecutors by a change of residence but they invariably find him out and renew their diabolical work. After having identified some individual as the author of his trouble, or as the head of a group conducting these persecutions, he may attempt to avenge himself upon his enemy and a homicide result. So dangerous may a paranoiac become, that the subject seems worthy of special consideration. The most forcible case that has come under my observation was that of an Austrian who was a waiter in a restaurant and who killed a fellow waiter. He was suspected of having mental trouble so that a commission was appointed to determine his mental status, with the result that he was found to be a lunatic. The man was then committed to the Philadelphia Hospital for the Insane, and while there, together with another inmate, he murdered one of the patients. A few years later this paranoiac escaped and was traced to a town in New Jersey. The authorities of the town were notified that he was an escaped lunatic and also of the dangerousness of his character. In the meantime he had been working quietly in a restaurant and had gained the confidence of those about him, so that it was not deemed necessary by them that he be returned to the hospital from which he had escaped. In 1913 letters which were threatening the life of the President were definitely traced to this man, who was still faithfully performing his duties as a waiter. Upon its being established that he was the author of the letters, the local authorities recalled what had been previously said concerning his dangerousness, when he was at once returned and committed to a state hospital for the criminal insane. This is a most striking instance of a paranoiac who had already murdered

one man, had helped to murder another, and was planning to take the life of the President, but yet who conducted himself with so much propriety that his homicidal insanity was not for one moment suspected by those about him.

The expansive stage is characterized by a change of personality, wherein the individual comes to believe that he is some exalted personage, perhaps of royal lineage, a prophet, or the son of God. Some paranoiacs have become great leaders or reformers and in such ways have illuminated history. It is claimed that Mohamet and Swedenborg were paranoiacs, but they also have been charged with being epileptics. The career of Jeanne d'Arc conforms closely to that of a paranoiac. The enthusiasm and persistence with which they attempt to carry out their "mission" may render them so obnoxious as to necessitate placement in a detention hospital. Others are more or less inoffensive, particularly if they are not too actively opposed.

The final stage of secondary dementia does not always develop, but frequently there is a weakening of their insane manifestations, such as hallucinations, persecutory delusions, and those of exalted personality, so that the individual may become less troublesome and less dangerous than at an earlier period. Often in this state they are found to be quiet institution inmates without their insane persistence and litigious tendency.

Certain types are described, such as acute paranoia and periodic paranoia; then there are the important groups of reformers, and religious and erotic paranoiacs.

Acute paranoia is an unfortunate term. What one really observes is the occasional development of a temporary paranoid state, such as is seen in toxic conditions and in which hallucinations may or may not be present. Most present-day writers maintain that paranoia is essentially a chronic disorder, but with mild and abortive types sometimes presenting themselves.

Periodic paranoia is likewise an unsatisfactory designation, even when applied to those cases which from time to time show marked amelioration of symptoms. The reformers constitute a group of egotistical, fantastic, and mentally inferior individuals, who go about attempting to achieve some

great social reform, or who may have some "invention" through whose instrumentality they expect to confer lasting benefits upon mankind. They sometimes journey to distant parts and suffer great privations in order that their plans may succeed. Their creative faculty is always lopsided, therefore, their schemes are always impracticable. Often they are harmless "cranks" most of whom eventually drift to institutional care.

The religious paranoiac of mild degree may be seen in our large cities where he succeeds in holding the attention of a crowd on Sabbath afternoons, which while perhaps regarding him as a bit eccentric, still consider him very devout. A more pronounced type become disturbers and possibly dangerous, so that they may find residence in asylums. The religious paranoiac is found quite as frequently among women and not uncommonly there is an erotic trend to these pious but deranged individuals.

True erotic paranoia probably does not occur separately, but many patients show more or less of a tendency in this direction. Masturbation is common and often the sex desire is somewhat fantastic so that offenses of sexual perversion are sometimes committed. These patients are quite prone to charge infidelity against those whom they marry.

The course of paranoia runs over a period of many years and some, under good institutional care, die of old age. The disease progresses very slowly and a secondary dementia may develop. There may be remissions but the complete restoration of a well marked case probably never occurs.

The *diagnosis* of paranoia is not difficult, but in the milder forms one should bear in mind that the condition may be simulated by individuals whose education has been faulty, who have been pampered, and who, when not allowed to have their own way, may stoutly maintain that they are persecuted. Hysterical persons sometimes show this tendency and frequently a sex coloring is observed in their temperamental disorder. Certain intoxications and diseases at times yield paranoid states.

Treatment. Medicinally, nothing can retard the progress of the disease, though during those periods when the delusions are most compelling and dangerous assaults threaten,

recourse may be had to powerful sedation—even morphin—in the effort to avert a calamity. The individual should have mental occupation and should take enough exercise to promote physical well being. Those physicians who employ psychoanalysis extensively, speak of gratifying results in some cases. Where the manifestations are mild, the patient is often inoffensive and he may lead an extramural life, but once becoming dominated by delusions of persecution, he is frequently highly dangerous and should then be committed promptly to a detention hospital.

Paranoid States. These are occasionally encountered, occurring for the most part among syphilitics, alcoholics, and epileptics. Others are commonly found to have a lowered mentality as the result of an earlier dementia precox. A few cases of syphilitic insanity show a paranoid trend with delusions of persecution or those of exalted personality. Here should be some of the signs of neurosyphilis and the blood and spinal fluid may be looked to for evidence of this disease.

Occasionally, in chronic alcoholism, the condition known as pseudoalcoholic paranoia develops. The individual may be expansive, frequently there are delusions of persecution and those of marital infidelity are quite distinctive. The history of alcoholism may be obtained and often there is a brutish appearance to the face as the result of drink. Then there may be tremors, paresthesias, and forgetfulness.

The epileptic is antisocial in his nature, he feels the world is against him and this is pretty much the fact. Sometimes he believes himself a person of unusual consequence, perhaps with a "mission." When actually insane he occasionally becomes homicidal. In the epileptic there may previously have been attacks, either motor, vasomotor, sensory, or psychic, and one sometimes finds such physical evidence as scars.

In other paranoid states, the condition has resulted from a previous dementia precox, as seen in some "hobos," cranks, and degenerates. Possibly the history of a previous mental disease may be obtained. The individual's having been in some asylum may be a matter of record or he may be known previously to have been picked up for vagrancy or for larceny.

TRAUMATIC PSYCHOSES.

Under this heading are included those mental disturbances resulting from, or consequent upon, trauma to the head or brain, whereby distinct psychotic symptoms are produced. These conditions, however, are exclusive of heredity, alcoholism, or brain syphilis, and it must also be borne in mind that some of the typical forms of mental disease may be precipitated by trauma. Such an injury may vary from concussion of the brain without fracture, to brain injury of wide extent with fracture. The impact may be at any point on the skull, and the manifestations, which are either mild or severe, may appear soon after the injury or may develop at a more remote period. In a general way, the more extensive the area of cortex involved, the greater is the mental derangement.

A convenient classification for these disorders is: Disturbances which follow almost immediately and which subsequently subside completely; those in which recovery is almost complete, but which leave the individual with the so-called traumatic constitution; finally, a terminal condition known as traumatic dementia may supervene.

Following concussion, the symptoms may be those of confusion or there may be unconsciousness. If the latter, the symptoms of shock or of collapse are usually seen, such as pallor, weak and rapid pulse, cold and moist extremities, headache, and often dilatation of the pupils. Delirium may be manifested. Sometimes there is impaired memory or an actual retrograde amnesia; irritability, childishness, or apathy; melancholic, or hypochondriacal periods; emotionalism, rage, convulsions, and even violence. Such symptoms constitute more or less the state known as traumatic delirium. When there has been an organic injury to particular parts of the brain, such localizing symptoms as Jacksonian convulsions, hemianopsia, aphasia, and other motor and sensory manifestations may appear. Occasionally there develops temperature with insomnia, convulsions, paralysis, and finally coma, which speaks of abscess or meningoencephalitis.

The traumatic constitution that sometimes follows trauma to the head, develops slowly, and has been described by

Friedmann as having its origin in vasomotor instability. Here vertigo, periodic headache, insomnia, bodily fatigue, brain fag, irritability, and explosive emotionalism, may appear. Dream states and hysteroid, epileptoid and paranoid manifestations are sometimes experienced. Of some importance in this state is the post-traumatic intolerance to alcohol, and there is also lessened resistance to heat and to the use of tobacco.

In traumatic dementia there is a slowly developing mental enfeeblement, which follows in the wake of trauma, and this is shown by a very gradual change in the personality of the individual; that may or may not be associated with aphasia, epileptiform seizures, and arteriosclerosis. The defect is one of general intelligence, with a gradual falling off in efficiency, failure of memory, and sometimes with moral deterioration. Usually, the dementia does not become marked, and after reaching a certain point remains stationary for years, while the patient continues fairly normal otherwise. The condition may at times be mistaken for paresis, toward which it bears some outward resemblance, but present laboratory methods of studying neurosyphilis should, together with the history of trauma, clear up the diagnosis. However, it must be born in mind that trauma to the head can precipitate paresis in one who has not yet shown the frank manifestations of this psychosis.

The *treatment* of shock must be carried out in a supportive way with external heat and cardiac and respiratory stimulants. Later, the patient must be kept quiet and free from annoyance. A fracture may require surgical intervention. When the state of traumatic constitution appears, much forbearance on the part of those intimately associated with the individual will have to be exercised. With the residual condition of dementia developing, some individuals may remain at home, while others must be placed in detention hospitals, there to end their days as public charges.

PSYCHOSES INCIDENTAL TO CHILD-BEARING.

The periods of pregnancy, parturition, puerperium, and lactation may be attended by mental disturbances which, however, are not distinctive, since they conform more or less

closely to those occurring at other times. Such factors as uremia and other intoxications, infections, emotional stress, and sometimes inanition, help to bring about psychoses during these periods. The strain incident to child-bearing may be sufficient to precipitate one of the classic types of disturbance in a potentially psychotic individual.

Insanity during pregnancy is not common and even when occurring, it is but seldom that a pregnant woman is admitted to an insane hospital. On the one hand this is due to the family's aversion to the procedure, and, on the other, to the reluctance of institutions to admit such cases. Those in charge of insane institutions have occasionally been horrified to learn that one of their patients has become pregnant during her detention, which, to be sure, is most embarrassing to the institution; but so far as the individual's insanity is concerned, she usually has gone forward to labor without any pronounced change in her mental state. Primiparæ are not more frequently afflicted with insanity than are others. The state of pregnancy is usually attended by some nutritional disturbance, so that morbid cravings for food, longings, pronounced emotionalism, capriciousness, and even moral perversions, are not so uncommon during this period. Pregnant women have been known to become mildly kleptomaniac. However, the mental condition most frequently encountered is that of depression, and this is a natural consequence in cases of illegitimacy except among the lower classes. The pregnant woman often wearies of people and things. She may imagine herself diseased in various ways, so that hypochondriacal manifestations are not uncommon. Her depression may deepen into a melancholia, with a delusional content showing self-accusation and with the charge of having committed the unpardonable sin. She may be seized with the desire for self-destruction, so that the utmost vigilance is required to prevent physical injury. These mental states are most likely to develop late in pregnancy, and usually they terminate with delivery. However, a few are affected during the entire period, with a continuation into the puerperium. Rarely, the condition becomes so aggravated as to render the interruption of pregnancy desirable. Occasionally, the state is one of pathological excitement, which may be more

or less continuous during pregnancy. Sometimes the symptoms are only general nervousness, restlessness, insomnia, and loquaciousness. On the other hand there may be great motor restlessness, hallucinations, delusions (particularly of persecution), with the whole condition totalling a mania. If the physical state is fair and the ancestry not badly tainted, the outlook is favorable.

During labor, psychoses may develop. This is most unusual and when occurring is most commonly found to be dependent upon bad kidneys, a hysterical temperament, or under great mental stress as in illegitimacy.

A post-partum psychosis, while not so rare, is less frequent than formerly, since strict asepsis is now more common in obstetric practice. The period of greatest danger is in the first few days, when the uterine vessels are still open and there are perhaps tears in the vagina and perineum. Later, a fissured nipple may be the source of infection. An anesthetic may be responsible for a psychosis, and extensive hemorrhage may lead to an hallucinatory and confused condition. Uremia, alcoholism and morphin sometimes cause psychotic complication, while emboli occasionally set up meningitis and encephalitis. An individual with hysteria or epilepsy may show frank mental manifestations. Most patients are hallucinatory and confused but a considerable number develop melancholia. The tragedy of a suicide, or even a homicide, is a possibility. Most puerperal psychoses are recoverable in from four to six months. A few recur with other pregnancies, and a patient of mine who has borne nine children, has had four such attacks, but the adult life history of this individual showed a manic-depressive trend to her mental make-up. The possibility of the patient drifting into a dementia must not be lost sight of. When death occurs, it is either from sepsis or exhaustion from motor unrest.

Lactational psychoses are those developing two months or more after childbirth and for the most part are dependent upon exhaustion, though possibly upon hemorrhage. Occasionally, there is delirium, often there are hallucinations and confusion, while rarely a stuporous state develops. Most cases appear among the lower classes who are underfed, not

properly nursed, and whose surroundings are unhygienic. When such mothers have particularly troublesome children to care for, mental breakdown is not surprising, and if in addition there is ancestral taint, a psychosis is almost to be expected. The first symptoms are those of general debility, emaciation, weakness, anemia, then there develop irritability, loss of the power to concentrate, lack of attention, failure of memory, confusion with hallucinations of vision and hearing. From being suspicious the patient may become terrified and attempt to injure herself, her child, or others. A rise in temperature may or may not be present. The condition lasts from eight months to a year, and while generally recoverable, is not so hopeful as when the psychosis has appeared in the post-partum period. Recovery is usually very slow and a few drift into a dementia.

The *treatment* of these period psychoses varies somewhat. If occurring in pregnancy, it may be desirable to interrupt the condition. When developing in the post-partum stage and upon a septic basis, surgical intervention may be necessary. Sometimes transfusion is required. Otherwise the treatment is tonic, supportive, perhaps with sedation and hydrotherapy. The patient must be skillfully nursed and the child provided for in some other way.

THE TOXIC PSYCHOSES.

Pellagra. Pellagra is endemic to some of our southern states and occasionally the disorder is encountered elsewhere. By no means do all cases show mental symptoms, though neurasthenic manifestations are rather common early in the disease, and rarely, a toxic psychosis does develop. Mental cases are for the most part among our poorer classes and so are apt to drift to institutions of detention. Spinal cord involvement is rather frequent, with variable symptoms, depending upon whether the brunt of the disorder is borne by the posterior columns or by the lateral columns. The mental manifestations may be those of depression, retardation, confusion, acute delirium, and sometimes with a rapidly progressive and fatal dementia, simulating a paretic dementia. Other mental types may be simulated, such as the manic-depressive group and an anxiety psychosis. Identity of the disorder is

dependent upon the associated intestinal disturbance and the skin lesions. Since the patients are usually poor, they can be best cared for in an asylum.

Carbonmonoxide Poisoning. This form of intoxication is not infrequent, sometimes resulting from attempts at suicide, though it may also occur accidentally. Patients with a depression psychosis of course may attempt suicide with illuminating gas, but the gas itself may also induce a psychosis which sometimes develops as late as ten or more days after the poisoning, while during the interim the individual has appeared normal. This late development of the psychosis is supported by the recent finding of the poison in blood intermingled with the spinal fluid, long after its disappearance from the blood stream. In fatal cases there have been observed congestion of the brain and its membranes, degeneration, especially in the lenticular nuclei, but also in areas of the cord and rarely in the peripheral nerves. The fact that the carbonmonoxide of illuminating gas has a two hundred times greater affinity for the blood than has oxygen, renders it a highly dangerous gas.

The temperature is at first subnormal, but later it rises rapidly. There is salivation and the face and extremities assume a cherry-red color. Leukocytosis is marked. Headache, restlessness, excitement, and drowsiness develop. Tremors and muscular twitchings appear, together with anesthesia and vasomotor paralysis. Finally, the patient becomes unconscious, the breathing is stertorous, and unless relief is speedily obtained, the patient perishes. If he recovers from the immediate toxic symptoms, there may appear later mental excitement, fabrications, amnesia, and emotional manifestations.

Diagnosis of the acute toxic state rests upon the history, the coma, the cherry-red color of the face and hands, and upon a spectrum analysis of the blood.

Treatment consists in the transfusion of blood or of normal saline solution, electrical stimulation, cardiac and respiratory stimulation and the persistent use of the pulmotor.

Carbonbisulphide Poisoning. This occasionally occurs among vulcanizers who are not properly safeguarded, in cleaning establishments, and in preparation of cellulose for

the manufacture of artificial silk, where the chemical is sometimes used. Poisoning results from inhalation, and the chemical appears to have a special affinity for the nervous system. While acute intoxication may occur, the chronic form is of most consequence. Various types are recognized, such as hysterical, pseudotabetic, and that of peripheral neuritis, while the psychic form is the most serious. Disturbances of vision are common and sexual manifestations occur—early there is apt to be sexual excitement, but later weakness and even loss of power. In the psychic sphere the disturbances are usually those of excitement or depression, but sometimes stuporous manifestations are present.

Some differentiation may be necessary from hysteria, multiple neuritis, tabes and the other forms of toxic psychoses. Severe intoxication may not be recovered from and the milder forms have been known to leave the individual with permanent disability. Treatment is symptomatic.

Other toxic psychoses, such as those due to alcohol, opium, and cocain intoxications, are considered under Diseases of Inebriety.

HEREDITARY CHOREA.

This disease, which was first described by Dr. Huntingdon and whose name it usually bears, is distinctly a development of middle life, often appearing at about forty years. Males are the more commonly affected, but in conformity to the rule so frequently observed in hereditary nervous disorders, females are the more concerned in its transmission. The disorder may, perhaps, develop along Mendellian lines. The first sign observed is excessive movements in the hands and feet, these increase and soon the body and head are similarly affected. The movements are not of muscle fibers, but are massive involuntary movements of groups of muscles. For a time the patient exercises some volitional control over the excessive jerking; ultimately, however, these incoördinate movements become actually violent. They are aggravated by mental and physical effort and are present when the body is at rest, but they are not manifested during sleep. Eccentricities of character appear and the patient becomes irritable, depressed, or emotional. Finally, he must remain in his

chair and later in bed, while the muscle unrest becomes so incapacitating that at last he cannot feed himself. Delusions of persecution appear and sometimes there are suicidal or homicidal tendencies. If the patient survives sufficiently long, a grave dementia overtakes him. The course of the disease is irregular and by no means do the motor and the mental symptoms keep pace. The affection lasts for many years.

Treatment is unavailing except in a supportive sense and unless the family is well-to-do, institutional care best meets the requirements.

DISEASES OF INEBRIETY.

ALCOHOLISM.

In a general way, the period of alcoholism is middle life, for it is then that both the mental and the physical activities are at their height. Among civilized people the desire for success may tempt them to increase their power of endurance through artificial stimulation, and if failure threatens, either there is an unwillingness or an inability to bear the strain without recourse to false support. The immediate effect of this is to the advantage of the drinker, but ultimately alcoholic excesses lead to permanent mental and physical impairment. Nor is this all of the harmful effects—the offspring too may be blighted in mind and in body. On the other hand, it must be borne in mind that a drunken parent may have healthy and even brilliant descendants. The recent Prohibition Act has changed somewhat the aspect of the alcoholic question. At first there was noticed an enormous decrease in all forms of alcoholic excesses, which was largely due to the inaccessibility to alcoholic beverages, to a fear of poisoning from those that were available, and in a limited degree to submission on the part of dealers and consumers to the newly established order. Later, dealers eager for gain and imbibers eager for drink caused a minor degree of drunkenness to again assert itself, so that to some extent through illicit distribution of alcoholic beverages, the disorders resulting from their disuse are still encountered. No one defends drunkenness, but the view held by some ex-

tremists, that alcohol is not a medicine and never should be employed as such, is not shared by most of us. What is said against its use may with even greater emphasis be argued against morphin, although of course alcoholism is relatively more common. But no one will say because morphin is a most dangerous habit-producing drug, that it never should be prescribed as a medicine. Unquestionably alcohol has destroyed useful people, but it also has helped eliminate many more who were not useful. Beer and light wines, which have always been used by civilized nations, are now scarcely obtainable, but wretched concoctions sold illicitly as whiskey appear to be quite abundant. History shows that the successful nations have all been alcohol users, while those which practiced abstinence have amounted to but little, such as Egypt, India, and Turkey. We were told that with prohibition there would be a great decrease in crime, but unfortunately all kinds of offenses have increased appallingly. To be sure, some of these are due to the lowered state of morals that inevitably follows war, but usually crime is in the mental make-up of the individual before he becomes addicted to drink. In this country the effect of beer and of light wine drinking as provocative of nervous and mental diseases was rather inconsequential, but great harm did result from the excessive use of strong liquors, which beverages contained approximately from forty per cent. to fifty per cent. of ethyl alcohol. An actual craving for drink does not usually begin before adult life and often it terminates, either through loss of desire or perhaps death, by forty-five years. One harmful effect of alcohol is that indirectly it contributes to the spread of social diseases, not through the stimulation of sexual desire, but through its lessening of self-control, chances are taken that otherwise would not be risked. In addition to the kind and quantity of the alcoholic beverage consumed, individual susceptibility is of great importance, with heredity as a strong etiological factor. A single dose of alcohol will lower blood pressure, but its continued use leads to arteriosclerosis and hypertension. One individual may consume a quart of whiskey a day for a long time without the appearance of intoxication, while another becomes delirious under the influence of a very small amount. The steady drinker is almost cer-

tain to show deterioration after years of use, though occasionally men have reached an advanced age who are known to have used strong drink excessively most of their life. The periodic drinker is often harmed less by alcohol than is the steady user, but periodic alcoholic debauchery is sometimes due to a manic-depressive trend in the mental make-up of the individual. Drunkenness becomes pathologic when it causes the drinker to commit unusual acts—sometimes of violence—or when it gives rise to other deleterious effects. Following the intemperate use of alcohol one may meet with various types of mental manifestations, such as delirium tremens, Korsakow's psychosis, alcoholic hallucinosis, pseudoparesis, pseudoparanoia, and alcoholic epilepsy.

Delirium Tremens. This is an acute disorder which develops upon a basis of acute alcoholism and is characterized by delirium, hallucinations, tremor, and toxic symptoms. It may develop gradually or abruptly, and sometimes it is precipitated by the too sudden withdrawal of liquor; trauma, physical or mental, are also said to be exciting causes. In a well developed attack visual hallucinations of a horrid and a terrifying nature are conspicuous; there is mental depression, apprehension and confusion; tremor, insomnia, anorexia and weakness are manifested; the heart action is often weakened, but there is seldom fever; sometimes the pupils react sluggishly, albuminuria is often present and there may be epileptiform convulsions. The disorder usually lasts three or four days, with a mortality of ten per cent. or fifteen per cent., in which death is due to acute cardiac dilatation, pneumonia, or "wet brain."

Treatment should be supportive, with free elimination through the bowel, kidneys, and skin. Sedation may be obtained through the use of bromides, paraldehyde, and possibly chloral; strychnin and digitalis are often indicated, and hypodermoclysis may be necessary. Careful feeding, possibly through a tube or even by the rectum must be employed. In the event of extreme violence, restraint may be necessary.

Korsakow's Psychosis. This disorder, while usually due to alcoholism, has been known to develop from infections like typhoid, from the intoxications of diabetes and uremia, and in metallic poisoning from lead and arsenic. While a

polyneuritis has been considered a necessary accompaniment, this does not always hold true; delirium may or may not be present, while disorientation is a pronounced feature. Memory for recent events is unfaithful, which defect the patient often attempts to overcome by various rather characteristic forms of grotesque fabrications, implicating himself in many impossible and ridiculous incidents. The disease is a serious one, though in mild cases recovery does occur; others who do not die may be left as physical or mental cripples.

Treatment is that employed in other intoxications, with the application of devices to overcome deformities which might otherwise result from the neuritis.

Acute Alcoholic Hallucinosis. Sometimes there develops an acute auditory hallucinatory disorder lasting for an indefinite period and accompanied by delusions of persecution and of jealousy, but without disorientation or fabrication. The "voices" heard often accuse the patient of sexual irregularities and deviations. While these mental symptoms have a paranoid trend, the disorder is not chronic, which differentiates it from true paranoia; from delirium tremens it may be distinguished by the great preponderance of auditory hallucinations. The disease usually subsides after a few weeks or months but occasionally a patient will drift into a chronic state of mental derangement.

Alcoholic Pseudoparesis. In a case of chronic alcoholism there may appear the symptoms of expansive delirium, ataxia of the gait and speech, rigid pupils, and tremor, which manifestations approximate paresis; however, the patient may have a history of dissipation, the brutish face that is sometimes shown by the drinking man, but without the positive blood and spinal fluid findings of the paretic, together with a lack of other evidence of neurosyphilis. Withdrawal of alcohol will cause a subsidence of the symptoms.

Alcoholic Pseudoparanoia. Sometimes a chronic alcoholic will make the charge of marital infidelity and will have delusions of persecution, all of which clear up under enforced abstinence; such patients may, from believing themselves grievously wronged, become dangerous.

Other conditions resulting from chronic alcoholism are recognized, such as alcoholic epilepsy; here, fits occur only during, or just after, a spree; such an individual shows the alcoholic make-up, but lacks that which is characteristic of the epileptic. Dipsomania is a term signifying a sudden, irresistible desire to drink which is then followed by an interval of freedom from such a desire. One may also meet with an alcoholic amnesia and a dissociation of personality, which conditions sometimes present perplexing medico-legal aspects. The mildest form of disorder that may result is a slow deterioration, shown by irritability or undue humor, suspicions and jealousies, carelessness, untrustworthiness, fabrications, and a general lessening of the physical, mental, and moral forces.

MORPHINISM.

Among narcotic drugs, opium and its derivatives are the substances most frequently employed by addicts. Crude opium is sometimes chewed, prepared opium is smoked, and laudanum is drunk, but most frequently it is morphin, heroin, or codein, that are used, either hypodermatically or otherwise. Some years ago the number of habitués was increasing enormously, but at present two factors render statistical inquiries on this subject difficult. Undoubtedly enforcement of rigid laws controlling the distribution of narcotic drugs has restricted their use, but as a result of the recent prohibition act, some alcoholics have turned to drugs to satisfy their cravings.

People of the present-day are as unwilling to bear pain as were those of an earlier period; the injudicious administration of narcotic preparations to relieve suffering, in such disorders as sciatica, colic, tabes and dysmenorrhea, has fastened the habit upon many persons; the nerve racking diseases of neurasthenia, hysteria, hypochondria, melancholia and alcoholism are afforded great temporary relief through the use of morphin; some psychopaths and degenerates take naturally to vice, becoming at once its votaries, and these individuals are particularly prone to adhere to the use of drugs.

One is amazed at the matter of tolerance in morphinists—forty and sixty grains daily, or even more, are at times used;

and laudanum is sometimes drunk in enormous quantities. Another surprising fact is the lack of degenerative effect upon the body as compared with alcohol, since from the long continued use of morphin, the arteries, kidneys and liver show but little involvement; neither are the offspring tainted to the same extent. While the moderate use of morphin may be carried on for years without any pronounced effect upon the mind and body, in this country many users of the drug become rapidly excessive in their indulgence.

The appearance of a confirmed morphinist is quite characteristic. The skin becomes yellow, anemia is present—opium cachexia—and the activity of the secretions is markedly lessened, leading to sluggish peristalsis and obstinate constipation. A whole host of minor affections of the gastrointestinal tract, and the urinary and respiratory systems, is common. The pupils are contracted—perhaps pin-point—and inactive to light. The skin and tendon reflexes are diminished. Impotence is the rule. In certain concealed parts of the body the integument may show scars and pigmentation from long continued use of the hypodermic needle, and this is an important diagnostic point. The mental symptoms are insomnia, with a gradual lessening of all the intellectual processes, and with such moral deviations as will render the individual's personality an exceedingly unpleasant one. The morphinist is irritable, untruthful, sometimes dishonest, and may show a criminalistic tendency. The condition approximates insanity, but seldom may the individual be detained in an institution upon that ground; and unfortunately he may live for many years in this state.

Such symptoms as are produced by sudden deprivation are worthy of note. In a few hours the morphinist becomes restless, anxious and weak; tremors, sweating, cramps and diarrhea are experienced, and collapse is imminent; the craving for the drug may become pitiful, but occasionally the victim's suffering is relieved through the development of delirium.

In the matter of *treatment*, the untrustworthiness of the drug addict renders institutional care desirable. Three methods of procedure are open to the physician: The drug may be stopped abruptly, it may be withdrawn rapidly, or

it may be reduced slowly. Without giving these methods in detail, it appears worthwhile to remark that some morphinists run counter to the established order of things, and as a result are ordered to penal institutions; there, the treatment of choice is the sudden and absolute withdrawal of the drug; recovery is usually so prompt that the procedure is desirable, except where a pronounced physical debility renders it inadvisable; obviously, this method of treatment cannot be carried out so completely elsewhere. During the first few days the patient should be kept under control through the use of trional, medinal, or luminal, and with the administration of such other remedies as the symptoms indicate. Unfortunately, if morphin becomes again available, most of those who have become confirmed users return to the vice, and the combination with other narcotic drugs or alcohol, makes the outlook particularly gloomy.

COCAINISM.

Cocain came into general use after 1884, when its value as a local anesthetic in ophthalmic surgery was discovered. The injudicious administration of the drug in diseases of the nasopharynx, has occasionally led to the habit, and because of its producing physical and mental stimulation the drug was formerly used in the treatment of morphinism and alcoholism, which, unfortunately, frequently resulted in the individual's becoming a combined addict. From periodic use at first, cocain takers drift rapidly into its continued use, and since its effect soon wears off, the drug is resorted to at frequent intervals. The debilitated and the neurotic take to it readily, and the poorer classes fall an easy victim to its charms. The habit is common in some parts of the south, and criminals are sometimes users of the drug. It comes as a great temporary solace to those already exhausted from other drug excesses. Cocain is the worst of drugs to enthrall its devotees, luring them to an almost hopeless captivity. Soon, it induces physical, mental, and moral deterioration, often leading to rapid death, but not commonly to a permanent insanity.

The symptoms presented by a cocain addict are rapid emaciation; the individual is distressed of countenance, is

restless, talkative, and secretive; the skin has a pale, yellow and withered appearance; the eyes are sunken and the pupils dilated; there is muscular weakness and tremors; the extremities are cold and cardiac irregularity is not uncommon. The cocaineist is constantly changing his plans, so that work of various kinds is started only to be abandoned later. Sometimes from the poisonous effects of the drug, and perhaps also from a marasmic condition, there develops an hallucinatory phase, beginning with great restlessness and distrust, from which the individual passes rapidly into a condition of irresponsibility. The special senses may be involved, vile language is often heard, and they hear persecutory threats shouted at them. They imagine seeing small black spots wandering over a light surface, see vermin of various sorts about the room or upon the clothing. A most common sensation experienced is that of insects crawling under the skin, which is known as Magnan's sign and has been termed the "cocain bug"; this sensation of bodies under the skin is characteristic of cocaineism. Needle pricks are felt, and many other painful sensations are experienced. The patient may believe these sensations are due to the machinations of his fancied persecutors, a homicidal insanity may develop at once, and he may proceed to arm himself for the destruction of his supposed enemies. Accusations of marital infidelity are quite common, and he has now become an exceedingly dangerous person. Rarely, in this condition of physical and mental torture, he commits suicide.

When a combination of drugs is used, the diagnosis may be quite difficult. The cocaineist is erratic, secretive, distrustful, and inclined to be solitary. This is not usually true of the morphin user. It differs from an alcoholic psychosis in the peculiar form of skin sensations, the more severe character of the maniacal manifestations, and in the absence of albuminuria; the administration of a single dose of cocaine will aggravate the condition, while little or no effect will result if the patient is an alcoholic. From paranoia it may usually be observed that the delusions are less systematized, less constant, and more numerous. If the patient is treated early, the prognosis is perhaps more favorable than in either morphin or whiskey addicts. However, except in the early

stage, a permanent cure is exceedingly rare. Those individuals who use a combination of drugs are the least hopeful.

The chronic patient may be *treated* by stopping the drug at once, by rapidly reducing it, or it may be slowly withdrawn. In many cases its immediate withdrawal will be the most satisfactory, for the reason that during the gradual reduction it sometimes happens that the patient will not remain under treatment when the discomfort incident to the partial deprivation manifests itself strongly. In those states where institutional detention is lawful, patients are more easily managed by confinement. If maniacal symptoms are present, they usually subside when the patient can no longer obtain the poison. The suffering attendant upon deprivation is not so great as in the morphinist, but there is danger of the symptoms of collapse for some time after the drug has been withdrawn. Strychnin is a sustaining remedy; the mental distress may be relieved by hyoscyamus, valerian, or large doses of the bromides; the appearance of collapse should be met by the administration of cardiac stimulants; insomnia is best overcome by prolonged baths; nourishing food should be given at frequent intervals.

CAFFEINISM.

Humanity has always craved something to soften its sorrows or to add to its pleasures, and when deprived of one substance that has afforded this gratification, has immediately sought another. Almost half of the coffee output of the world comes to the United States, and probably no country, except Holland, consumes more per capita. Formerly, we used more than eleven pounds annually per individual, but for the year ending June 30, 1920, owing to the effects resulting from the Prohibition Act, we consumed almost four pounds more per capita. With us, there is no longer much adulteration, but injury frequently results from insufficient roasting, which leaves the coffee-bean weighty and which prevents the vaporization of certain harmful products. Coffee contains three important ingredients: the alkaloid caffeine, the volatile oil caffeol, and caffetannic acid; to each of these has been attributed its harmful effects but it is probable that caffeine is the greatest offender. Coffee should be thor-

oughly roasted, finely ground, and then strained through cotton cloth; it should never be boiled. Many alcoholists and morphinists have used coffee to excess before arriving at their baser inebriety. A patient of mine who drank a pint of black coffee at frequent intervals, was a dipsomaniac and also was afflicted with kleptomania. Some users have been known to chew the coffee-bean. Indoor workers and those who are temperamentally nervous, do not bear coffee so well, and the habit is more common among women. Coffee shows a slightly laxative action, due to an irritating oil which it contains and which also gives rise to indigestion.

Following the drinking of a moderate amount of coffee there comes an increased capacity for physical exertion, or if the individual be fatigued, there will be a loss of this feeling. The same may be said of the psychic sphere, for coffee is a true brain stimulant; under its influence ideas become clearer and flow more rapidly, fatigue and drowsiness disappear, and the special senses are rendered more acute. A secondary fatigue, such as is seen after the taking of alcohol, is almost wanting. After the prolonged use of excessive quantities there results emaciation, weakness, trembling of the hands which is sometimes noticeable even when they are at rest. Anorexia and indigestion are common. The pulse is rapid, sometimes irregular, there is palpitation with precordial distress, and ultimately a hypertonicity in blood pressure. The mental symptoms of depression, headache and insomnia occur, and in extreme cases convulsions have been noted. Most of the symptoms subside after the discontinuance of the beverage, and the general debility will usually be found to respond to reconstructive treatment.

Tea, next to water, is the most widely used beverage and as a drink antedates coffee by many hundred years, since in China, where the water was infested with typhoid, dysentery and other germs, tea drinking was regarded as a medicinal measure; obviously, any benefit derived lay in the boiling of the water. In this country tea inebriety is most frequently encountered among the Irish and the Russian populations. Rarely, one meets with an individual who chews tea-leaves. The active and the most harmful principle is thein, and when taken to excess is attended by as much

injury as is caffein. Tannin also in any considerable quantity is harmful and frequently leads to indigestion through an active precipitation of proteids. Tea should not be boiled, but an infusion should be made quickly, since by this method only a little of the thein and tannin are extracted.

NICOTINISM.

Tobacco is smoked and chewed, and also is used in a powdered form known as snuff. Great difference of opinion exists as to whether, when taken in moderation, it is harmful. Those most temperate in their views hold that tobacco of good quality, not too strong and not used to excess, is without injury, provided there is no idiosyncrasy. It is significant that insurance companies, always watchful of their interests, have attached no great importance to the use of tobacco. There are contradictions to its use as in certain affections of the heart, dyspepsia, respiratory disorders, eye affections, and nervous conditions. Tobacco is least offensive in the form of cigarettes, except when the smoke is inhaled; then follow cigars, the pipe, and most harmful of all is chewing. In heavy smokers there is a tendency toward an increase in blood-pressure, thus promoting arteriosclerosis. It is doubtful if excessive smoking causes carcinoma about the mouth, though trauma, from smoking a pipe, may be conducive to the development of malignancy. Certain beneficial effects are claimed for moderate smoking, and no less authority than Clouston says, "it tends to calm and continuous thinking, and in many men promotes the digestion of food." Perhaps there is a psychic element in the hold smoking has on one, since it is less satisfying to smoke in the dark and few blind men enjoy smoking. Excessive use of tobacco leads to irritation of the pharynx and the larynx. The functional disorder of "smoker's heart" may develop, a condition which includes palpitation, tachycardia, arrhythmia, and possibly syncope. Sometimes dimness of vision, impaired accommodation, and myosis may result; if destructive changes occur, alcoholism is usually associated. Anorexia, dyspepsia and gastric catarrh are present, and eventually emaciation and anemia occur. There is lack of energy, retarded mental action, insomnia, vertigo, headache, and neu-

ralgic pains. The tendon reflexes are increased, and muscular weakness and tremors are present.

Snuff, which is tobacco specially prepared by the process of fermentation and then finely powdered, was formerly in almost universal use. It is now consumed but little except by the negroes in the south and by some of the inhabitants in the northwest. In the latter region, however, the powder is often chewed and, if one may believe reports, the habit is assuming serious proportions. Its victims are said to develop ulcers inside the mouth and show marked evidence of physical and mental intoxication, and in some instances even develop a psychosis.

In excessive use of tobacco, withdrawal of the substance usually leads to prompt subsidence of the symptoms, but limitation and avoidance of inhalation are often sufficient to overcome the harmful effects.

PSYCHOPATHIC PERSONALITIES.

Many eccentric characters exist who may not be classed as insane, but who in some instances may have had earlier in life a mild psychosis, such as dementia precox, and from which only partial recovery was made, thereby leaving them somewhat mentally dwarfed. A few of these individuals ultimately become permanently insane, while others always remain queer and are classed as "cranks." History shows that a touch of genius may be observed in a few of these persons, so that their efforts if concentrated in a definite direction sometimes prove rather remunerative. But many lead lives of inefficiency and the poorer class often become vagabonds or not infrequently are found in penitentiaries, jails, or alms-houses. These individuals are always more liable to develop a psychosis than is the general population. Their malady is a mental one and often they are found to have average physical health. Sometimes there is an obvious hysterical strain in their mental make-up and, as we all know, hysterical persons as a class lead lives of inefficiency. Of recent years, my personal observation has revealed more major hysteria among penal inmates than has been seen elsewhere. Frank epilepsy is encountered in a few and the epileptic character with its egocentricity and social inadaptability.

bility is frequently met with. They are prone to alcoholic excesses, often in the form of periodic debauches, and some even becoming dipsomaniacs. All manner of offenses may be committed during a state of intoxication and, since drunkenness usually affords no protection to the offender, they are frequently the subject of medico-legal inquiry. Sexual excesses are likewise common and far beyond that usually seen, so that libertines, bigamists, and others who indulge in sexual vagaries, are sometimes found among this group.

Several types are well known. Pathological lying and swindling are degenerate acts which are almost invariably associated with other character deviations. In a case reported by me, beside the abnormal fabrication there were two attempts at homicide (one successful), three attempts at suicide, probably rape, and possibly simulation of insanity. As Kraepelin says: "Here we have, in general, to deal not only with hyperexcitability of the imagination and defective faithfulness of the memory, but also with a certain unsteadiness in the sphere of the emotions and of the will."

Pseudoquerulants, while presenting something of the outward appearance of paranoiacs, differ from them in not being actually delusional nor dangerous; also, their condition remains practically stationary, not being progressive as is paranoia. However, they give rise to much trouble through quarreling, the threatening of litigation and not infrequently actually resorting thereto. These individuals are not well balanced intellectually, though often they possess considerable cunning and exhibit colossal conceit. Their quarrels are not prolonged and after one is settled they seem to forget the matter, but soon they discover other grievances which cause them again to institute legal proceedings.

Formerly, the distinctly criminal class were rather loosely grouped as moral imbeciles or as individuals possessed of a moral insanity. These terms are unsatisfactory, since they imply irresponsibility, which might carry with it immunity from proper punishment. The moral sphere and the intellectual sphere, while to some extent dependent upon each other, may still vary in their development, and in the "born criminal," as Lombroso termed one group, the individual is sadly wanting in his moral sense.

The *treatment* and care of individuals with a psychopathic personality is a difficult problem. Some are inoffensive and may be of small concern. Those given to alcoholic excesses can in some states be detained in hospitals for varying periods of time. The psychotic, also, if mentally incapacitated, can be placed in detention hospitals. Those guilty of misdemeanors will from time to time be subjected to prison sentences while others will drift to alms-houses. But there still remains a group whose individuals escape the various hospitals and institutions, and who by reason of their activities continue to be more or less of a nuisance in their respective neighborhoods.

SEXUAL ANOMALIES.

Nature has placed within beings a powerful sexual appetite in order that the various species will propagate and thereby perpetuate themselves. Through some means difficult for us to understand, sexuality among human beings is often less decent than among the lower animals, since it has been prostituted to the extent that sexual indulgence is frequent, with procreation proportionately a very diminutive quantity. Nor is this the worst of sex vices, for occasionally sexual gratification is procured through the basest and most perverted means, which acts constitute one of the blackest pages of human history. The perpetrators of these monstrous vices do not usually consult physicians concerning their weaknesses, since they seldom desire to overcome them, so that these individuals are most frequently encountered in penal institutions, where they are undergoing sentence for some sex crime; or, by reason of the usual channel of sexual indulgence having been shut off, they may have acquired the vice in jail. The navy and to a lesser extent the army yield a few devotees to these vices. As a class such individuals are usually psychopaths and a few in time actually become insane. The drive of the passions shows a noticeable weakening by forty-five years, though occasionally degenerate acts are committed by the old of the male sex.

Homosexuality. Sexual desire for those of the same sex is sometimes so pronounced as to render contact with the opposite sex repugnant. In some males this desire is so

compelling as to cause them to don female attire, and they are particularly attracted not by those of their own cult, but by men, normal and strong in appearance. Some such men are astonishingly feminine in their outward physical appearance as well as in their actions. However, these individuals are not always obviously effeminate, since some of the world's great men have been charged with the vice of love for their own sex. It is a fortunate feature of the practice that procreation cannot result, so that it tends to die out. When the vice appears in the female, it is spoken of as Lesbian love. Such women are prone to feel, dress and act like a man toward other women, and they have even been known to live together, outwardly, as man and wife.

Fetichism. This trait reveals itself normally in some religions, where the sight of certain objects is sufficient to produce religious ecstasy. Erotic fetichism, while common to a very limited extent and perhaps harmless, may become so pronounced as to be distinctly a part of the mental make-up of the psychopath. In some, extreme sexual excitement and gratification may be had through the sight of, or through contact with, certain articles of wearing apparel or certain parts of the body. The objects necessary to exert such a charm may be of various kinds; a slipper, a handkerchief, or a lock of hair.

A case with which I was thoroughly conversant was that of a man who came of distinctly psychopathic stock. He had married and was the father of three children when his wife refused him further sexual intercourse. Previously, he had observed that coming into the presence of women who were veiled—particularly when they wore a harem veil—sexual excitement followed, even to the extent of producing an orgasm. This plan he then adopted as his means of sexual gratification, and in order that he might gratify himself fully, selected from among others one woman whom he maintained in ease and comfort. She was sexually unattractive to him when without a veil and he never had natural sexual relations with her. This life satisfied him but the maintenance of two establishments led to his embezzling twenty-four thousand dollars, for which crime he served a two-year sentence in a penitentiary. This prisoner's wife, who was

conversant with his weakness, since she herself had worn a veil for his sexual gratification, confirmed most of the details related to me by the prisoner.

Sadism. This is perverted sexual gratification, usually encountered in males, practiced toward the opposite sex, in which violence and cruelty are associated with the sexual excitement. To a minor degree unnecessary violence is sometimes practiced among ordinary individuals during the sexual act, and this is an expression of sadism in its mildest form. Some perverts cannot satisfactorily perform coitus until they have inflicted pain. The extreme of the condition is found in those fiends who after having committed an atrocious murder, proceed to sexual indulgence or other sexual revery with the body of their victim. Where the sexual relation is with a dead body which has been the victim of a murderous assault, or where the body is accidentally encountered as in an undertaking establishment, the act is termed necrophilia.

Masochism. This is the opposite of sadism and sexual gratification is found through subjection to force and the enduring of pain. Such suffering is usually born by the man.

Exhibitionism. This act consists in exposure of the genitalia to the opposite sex, and is confined almost exclusively to males, although, rarely, it has been observed among insane women. Some such individuals show a frank mental disease, as paresis, epilepsy and alcoholism, but another and an important group, are just morally weak and find sexual gratification through such exposure. Occasionally, these individuals are picked up in parks or other public places which are frequented by girls and women. The offense consists in the indecency of the act, as such men are otherwise harmless, never attempting an assault upon females.

Bestiality. Sexual gratification through intercourse with animals is occasionally encountered among the feeble minded and the degenerate. Women have been known to copulate with dogs. Such acts, while most revolting in their nature, are unattended by venereal infection, or by the possibility of conception, so that they are not the worst of sexual anomalies.

THE ENDOCRINOPATHIES.

The vegetative system is now attracting much attention, though some of its affections are not yet well understood. This important system is composed of nerve ganglia, nerve fibers, and nerve plexuses, which supply the involuntary muscles, the pupils of the eyes, the glands and viscera, and the cardiovascular system and genital organs. It is composed of two separate systems each of which tends to control over-activity of the other; these are the autonomic system and the sympathetic system. Individuals vary greatly, depending upon which of these systems has the dominating influence.

The Autonomic or Vago-tonic Type. In such individuals there is believed to be prompt action to the substance called cholin. The symptoms of this type are shown as bradycardia, myosis, tendency to sweat, gastric hyperacidity, asthmatic tendencies, and a torpid bowel. Eosinophilia may be present and the sugar tolerance is high. This system is very responsive to the action of pilocarpin and its activity is retarded by the administration of atropin. The symptoms of the disorder may be general or they may be more or less confined to one of the anatomical divisions of the system—the cranial, the cervical, or the sacral.

The Sympathetico-tonic Type. Such individuals are characterized by their greater activity and excitability. There is a rapid heart action, dilated pupils, and the skin is dry and warm. Great susceptibility is here shown to the action of adrenalin, thyroid substance, and pituitrin. Many of the symptoms of Graves's disease are of sympathetico-tonic origin, as are those of the angio-neuroses such as angioneurotic edema, Raynaud's disease, and erythromelalgia.

One encounters much in the literature of endocrinology that is speculative, which in a measure may be due to a frequent pluriglandular implication, wherein the relative component gland values cannot yet be definitely determined. However, the fact remains that certain important diseases are recognized as originating through endocrine disturbances, hence the subject compels our attention. Furthermore, when it is realized that in the lower animals, removal of either

the adrenals, the parathyroids, or the pituitary body, is followed by death, one feels that at least some of these organs must be of vast consequence during life.

The list of structures contributing important internal secretions has from time to time been enlarged, and in the matured adult the principal organs that so far have been shown to be active are the thyroid, parathyroids, adrenals, pituitary, ovaries, testes, and pineal body. But as for the inclusion of such structures as the appendix vermiformis, which it is said contributes an important "energizing" substance to the economy—when all know patients who have not enjoyed good health until after their appendix was removed—one then cannot help viewing some of the writings upon this question with skepticism.

The secretions of the endocrine glands deliver to the blood certain chemic substances known as hormones, which, when carried to associated organs, excite functional activity, and such an influence is observed normally at puberty. This hormonal power may lead to excessive, diminished, or perverted secretion, and thus disease is sometimes established.

Thyroid Disturbances.

The most important and the best understood of the endocrine glands is the thyroid. The secretion from this organ contains much iodine, which substance, it is believed, is largely responsible for its activity. The chief influences attributed to its secretion are stimulation of the adrenals and mammary glands; regulation of the activity of the ovaries and testes; a protective action against toxins entering the blood, and perhaps the maintenance of a vicarious relation with the pituitary body.

Hypothyroidism. This condition results from the lessened activity of the thyroid gland, and the definite clinical entities ensuing are cretinism, which belongs to early life, and myxedema, which may result from disease of the gland, or a too extensive surgical removal may cause a myxedematous condition—cachexia strumipriva—to develop. Among the minor manifestations of hypothyroidism are dryness of the skin and of the mucous membranes, scleroderma, and perhaps

with pruritis, psoriasis, or ichthiosis. The hair becomes dry and scanty, and the extremities are cold. There is retarded cerebation and a lack of emotional response. Defective oxidation is present so that there may be rheumatic and arthritic manifestations. Gastric disturbances are common and marked constipation is the rule. In the female, often there is dysmenorrhea or amenorrhea.

Acquired myxedema is commonly a disease of middle life, with women the more frequently affected. This disorder may develop slowly after a goiter has led to extensive destruction of the thyroid, or to some disease of the gland (possibly syphilis), or it may appear rapidly after severe hemorrhage. The disease is characterized by a myxedematous accumulation beneath the skin and mucous membranes, together with progressive mental and physical enfeeblement. The skin is of a palish yellow color, dry, thickened, scaly, firm, and elastic, but it does not pit on pressure. The condition is most obvious in the face and the extremities. The nails and hair are irregular, dry, and brittle. Perspiration and sebaceous secretions are diminished, and the tendon reflex activity is diminished. The facial expression is quite characteristic: There is apathy, the lips and the nostrils are enlarged, the mouth is big and it may reveal a thickened tongue. In mental make-up the individual shows cerebral torpor, irritability, somnolence, and occasionally there are frank symptoms of disturbed mentality. Then there may be such general manifestations as cardiac irregularity, a small and weak pulse, subnormal temperature, headache, dizziness, hemorrhages, albuminuria, and sometimes with an accumulation of fat at unusual sites.

An operative myxedema occasionally develops after a too extensive removal of thyroid substance. The condition may appear in from three to six months, when it partakes of some of the symptoms just described. If the parathyroids also have been unwittingly removed, tetany follows. The progress here is not so rapid as in the preceding form, since other glands may act vicariously.

Jelliffe, in a preliminary statement concerning "Hypothyroidism and Tabes," relates the circumstance of a woman who had been pronounced a tabetic by a number of phy-

sicians, in whom there was found shooting pains, coming and going, loss of knee and ankle jerks, slight incoördination, slight sluggishness of the pupils, difficulty in thinking, and marked asthenia. At first Jelliffe confirmed the diagnosis, but a careful examination of the blood and the spinal fluid gave negative findings, and he then revised his diagnosis to that of a sub-myxedematous state. Institution of thyroid treatment caused a disappearance of the neuralgic pains, sluggish pupils, physical and mental fatigue, and a return of knee-jerks.

The *treatment* of hypothyroidism consists in the giving of thyroid substance together with the administration of a small quantity of iodine. Gland implantation has not yet, in the human subject, proven successful, though there is the possibility that it may be helpful in the future.

Hyperthyroidism. This condition arises from various causes and is a frequent accompaniment of menstruation. Toxic matter absorbed from the mouth or sinuses, or infective substance from any part of the body, may provoke hyperthyroidism. Following severe emotional excitement, which acts directly upon the adrenals, there is often a hyperfunction of the thyroid. One occasionally meets with a persistent thymus whose presence may be revealed by fluoroscopic study, and this is sometimes a source of irritation to the thyroid.

A minor degree of hyperthyroidism is common and usually precedes for some time the pronounced symptoms of exophthalmic goiter, which, therefore, offers the opportunity of instituting treatment before the disease has advanced to a stage where an absolute recovery is not to be expected. For the early recognition of hyperthyroidism one should look carefully for a tremor, which symptom is fairly constant; the heart may show beginning dilatation, the pulse is slowed but little by assuming the recumbent posture, and there may be a noticeable pulsation of the thyroid; eye symptoms may be apparent, flushing is common, and the appetite is usually increased. There is a decreased sugar tolerance, feeding on thyroid substance promptly aggravates the symptoms, and there is a positive Goetsch test, which is based upon the fact that the thyroid secretion sensitizes

the sympathetic nerve endings to the action of adrenalin. The Goetsch test is an important diagnostic point in distinguishing hyperthyroidism from incipient tuberculosis. As the disease advances it is recognized under the various names of Basedow's disease, Graves's disease or exophthalmic goiter, though occasionally the exophthalmos is wanting, as may be any other of the prominent symptoms. Heredity has some bearing and the disease is occasionally seen in stock



Fig. 3.—Exophthalmic goiter. (From "Diseases of the Nervous System," by Jelliffe and White. Third Edition. Lea and Febiger, Philadelphia.)

where epilepsy develops. Abortive types are frequent. Exophthalmic goiter is more common among females, but is infrequent after the third decade. The most striking feature is the prominent eyeballs, which give the patient the "tragic look." The most characteristic symptoms are the exophthalmos, tachycardia, and tremor; then there occur cardiovascular implication, skin and muscle symptoms, metabolic, gastrointestinal, genital and respiratory changes, together with manifestations in the psychic sphere.

Goiter. This is usually present and it varies in size, usually bearing a definite relation to the intensity of the disorder. Rarely, it develops suddenly and sometimes the growth recedes. The enlarged and often symmetrical mass is soft, elastic, and from its increased vascularity pulsates freely, which upon auscultation yields a systolic bruit. In the late stage the goiter may become cystic, possibly atrophic, when myxedematous manifestations may appear.

Cardio-vascular Symptoms. These are prominent. Dilatation of the heart may occur early and its tumultuous action is characteristic; often this leads to dizziness, redness of the surface, particularly of the extremities, and to precordial distress and psychic apprehension.

Ocular Manifestations. The protrusion of the eyeballs may be unequal or one only may be involved. An infrequency in winking is observed, incomplete closure of the eyelids, and failure of the upper lid to move synchronously with the eyeball; often convergence is difficult, and even ophthalmoplegia has been noted. Löwi has called attention to the frequent dilatation of the pupil upon the application of adrenalin. The lack of protection of the eyeball leads to lachrymation, conjunctivitis, and possibly keratitis with perforation. Photophobia and hallucinatory manifestations may be experienced, and rarely an optic atrophy may be met with.

Motor Manifestations. Tremor, which may be general, is an early and an important sign; usually it is fine but occasionally the more pronounced choreic or epileptiform movements are seen; muscular asthenia is present.

Vasomotor and Secretory Manifestations. Irregular blushing and a sensation of heat is common; dermatographia, epistaxis, urticaria, and circumscribed edema may occur. Often there is profuse and widespread perspiration, and this will give rise to an increased electrical resistance in the skin; then there may be albuminuria, and even glycosuria.

Gastrointestinal and respiratory manifestations are sometimes encountered and menstrual irregularities may be experienced. Metabolic changes are observed, the patients becoming weak and emaciated.

Mental Manifestations. These are important. The patient is emotional, depressed, and sometimes suicidal. An acute

and grave delirium may develop. Hallucinations and even delusions, usually of persecution, occasionally appear and a frank psychosis of the manic-depressive type has been described.

The course of exophthalmic goiter is chronic, though a case is reported with death resulting in three days. The usual range is from a few months to many years.

Treatment. All possible infective foci must be investigated. Rest in bed is in some cases imperative. On account of the iodine content, iodides must be avoided. In selected cases, x-ray treatments are of possible value. Bromides, belladonna and arsenic may afford relief. In aggravated cases the operative procedure of vessel ligation, or a partial extirpation of the gland substance, sometimes proves beneficial.

Parathyroid Disturbance.

Two pairs of parathyroid glands are in intimate contact with the thyroid, hence the danger of injury or even of removal in operations upon the latter. In the event of such an accident to the parathyroids, the symptoms of tetany will follow. These glands concern themselves with calcium metabolism and perhaps their secretion exerts an inhibitory influence upon toxins within the body.

Hypoparathyroidism gives rise to tetany, and some of the varieties described by Falta are traumatic, idiopathic (occupational), that due to disease of the thyroid gland, infectious diseases and intoxications, and the type that sometimes occurs during the period of maternity. In tetany there occur continuous or paroxysmal bilateral spasms, chiefly of the extremities, though most parts of the body and the face may be implicated. But seldom is there an attendant disturbance of consciousness. The disorder may be acute or chronic and it may be of a recurring type. The idiopathic form occurs epidemically in some European cities, where it appears among certain workmen—shoemakers and tailors—who are otherwise healthy. Occasionally there is hyperesthesia and sometimes the spasms are painful. The hands assume the obstetric position and the feet that of equinovarus. The face, tongue, neck, diaphragm, bladder and even the eyeballs

may be implicated. In the more chronic types, vasomotor, secretory and sometimes trophic disturbances are seen. Certain signs are quite characteristic of the disorder. Tapping over the facial nerve causes spasm in the muscles supplied (Chvostek). Pressure over large nerves and vessels causes spasm (Trousseau). There is a hyperexcitability to electrical currents (Erd). Also sensory hyperexcitability (Hoffmann). Usually, the jaw muscles are not implicated and this offers an important differentiation from tetanus. The chronic cases may last for a few months and possibly recur for a few years. Prognosis is not unfavorable unless due to extensive parathyroid removal or to acute gastric dilatation, either of which may prove rapidly fatal.

Treatment. Removal of the cause if this is possible. Medicinal salts of calcium should be prescribed, and foods containing such substances should be eaten. Parathyroid substance may be administered and the antispasmodics employed in severe attacks.

Suprarenal Disturbances.

The two suprarenal bodies rest directly upon the kidneys. The medullary portion of these structures contains the chromaffin cells which secrete the important substance known as adrenalin; this substance is now being made synthetically. The routine function of such tissue is said to concern itself with the regulation of emotional overactivity. Additional chromaffin cells are found along the carotids, the left coronary and superior mesenteric arteries, and also in parts of the sympathetic nervous system. The cells in these sites, and the occasional presence of accessory adrenals, probably account for the development of Addison's disease without an involvement of the medullary substance of the adrenal glands; also, of extensive disease of the same structures without the appearance of the symptoms of Addison's disease. The medullary and the cortical parts of the glands are somewhat interdependent, but the activity of the latter tissue is not yet well understood. Loss of these glands leads to great emaciation, prostration, apathy, and a lowering of blood pressure and of temperature. An acute hypoadrenalism can be caused by hemorrhage into the medullary substance and

this may be followed by rapid death. The milder forms are recoverable.

Chronic hypofunction of the adrenals for the most part reveals itself as Addison's disease which, generally speaking, is a disease of the third and fourth decades, and which usually develops upon a tuberculous basis. The disease often has a tumultuous course. At first there is a gradually developing asthenia—the patient is tired mentally, physically, and physiologically—and this state later leads to exhaustion. The blood-pressure is lowered and the output of urinary solids is diminished. There is a gastrointestinal atony leading to stasis, nausea and vomiting. The pigmentation in the skin and in the mucous membranes is quite characteristic. This is brownish in color and is encountered chiefly on the unexposed surface or at points where pressure or irritation is most apt to occur. The hair is sometimes affected and while the whole body may be tinted, the most pronounced pigmentation is in the areas surrounding the nipples, about the genitalia, in the anal folds, and in the edges of the eyelids. The disorder may be precipitate, with death ensuing so rapidly—as in the case of hemorrhage into the gland—as not to leave time for the discoloration to appear. Motor symptoms are common in the form of temporary paralyses, or myoclonic, epileptiform, and tetanoid spasms. Mental symptoms begin with apathy and inertia, later with delirium and confusion, possibly with a delusional phase, finally ending in coma and death.

Treatment must be supportive and perhaps adrenal substance should be administered.

Adrenal hyperfunction of marked degree is usually due to the development of tumors especially in the cortex, which part of the gland appears to influence the growth of the body, causing the development of hair and inducing precocity in the genital sphere. The most striking results of hyperfunction occur in children who prematurely and rapidly take on physical sex characteristics, but without a corresponding sex desire and certainly without precocious mental development. Sometimes, however, such activity is manifested in the adult, especially in the female, who then may show such a secondary masculine appearance, as the growth

of a beard. The changes may have been such as to leave the real sex of the individual in doubt, so that some have been classed as instances of pseudohermaphroditism. It is believed that such individuals may indulge in the perversion of homosexuality.

In the matter of treatment, organotherapy may be tried and a neoplasm might possibly require operation.

Pituitary Disturbances.

Terms used in respect to the anatomical division of this structure are somewhat confusing. The anterior lobe is now generally spoken of as the pituitary, and the posterior lobe as the infundibulum, while together they constitute the hypophysis. The pituitary portion is much the more important and disturbances here give rise to more or less definite manifestations, while its removal causes death. The activity of the pituitary is intimately concerned with growth of the body, particularly that of the bones and connective tissue, and the entire hypophysis seems able to come to the assistance of the thyroid, the testes and the ovaries when these organs lag in their activity. Hyperpituitarism leads to acromegaly and gigantism, the latter beginning in early life and causing lengthening of the long bones.

Acromegaly. The development of this disease is usually limited to middle life and it is commonly due to an adenoma or an adenosarcoma of the pituitary gland. The activity induced frequently causes changes in the thyroid, the gonads and the suprarenal cortex, so that a complication of symptoms often results. Gradually a change comes over the face of the individual, so as later to render him unrecognizable. The superciliary and malar regions protrude, the nose is enormously enlarged, and the upper and lower jaws increase in size, thereby causing a spacing of the teeth. The tongue is enlarged and the mucous membrane thickened. The clavicles increase in size and a kyphotic spine is often seen early. The individual hairs of the head are thickened and there may be an enormous increase of hair on the body and the extremities. The hands and the feet broaden, and the fingers and the toes thicken. While in the beginning the

disorder may lead to hypersexual activity, later, the reverse is true. Impotence occurs in the male, with amenorrhea and dysmenorrhea in the female. A thyroid implication may show marked symptoms of hyperthyrosis, and the manifestations of adrenal activity are sometimes observed. Carbohydrate tolerance is reduced and glycosuria is not infrequent. Later, the symptoms of intracranial pressure are sometimes present. There may be headache, vomiting, hemianopsia, disturbances in the visual field, papilloidema, and possibly blindness. There may be other cranial nerves besides the optic implicated. Pressure upon the crura cerebri would yield the familiar symptoms of pyramidal tract involvement, while pressure upon the uncinate gyri would cause the "uncinate fits" spoken of in epilepsy. Mental symptoms sometimes occur. An x-ray study usually discloses an enlarged sella turcica. In course, the disease is usually progressive, often ending fatally in from five to twenty years, though abortive types are sometimes encountered.

Hypopituitarism is most common in children, but occasionally adults are affected, in the latter the disorder usually resulting from syphilis, a neoplasm, or following traumatism. The symptoms are commonly those of localized fat accumulation, together with a lessening of function in the genital sphere. Asthenia and somnolence are often present. There is a tendency to subnormal temperature, dry skin, loss of hair, slow pulse, lowered blood-pressure, and possibly epileptic seizures or a psychosis.

The *treatment* of acromegaly is perhaps surgical. Hypopituitarism may possibly be benefited by an operation, also by the administration of pituitary substance, and perhaps by thyroid medication.

Pineal Disorders.

These are very infrequent. A tumor arising from this structure will cause some such symptoms as hydrocephalus, ocular palsies, a deposition of fat, and perhaps with changes in the genital sphere.

Surgical relief is possible, but in this region an operation is very difficult as well as very dangerous.

Testicular Disturbances.

The structural activity of the male gonads is in the gametic cells, which give rise to the spermatazoa, and in the cells of Ledig—interstitial cells—which appear to be the active internal secretion producers. Today, much is written about the remarkable rejuvenating power of the interstitial tissue. The experimental French surgeon, Voronof, has supplied us with reports upon the lower animals that show a measure of success. Here, the sex glands from the same species were used. Sometimes the whole testicle was employed, but generally it was a large fragment that was transplanted, though in some instances only a small portion of the gland was used. Of the sites chosen for grafting, the subcutaneous tissues, the peritoneum, and the scrotum, the last yielded much the best results. Following such experimental work, the reports of this surgeon state that old, timid and decrepit rams have later become full of spirit, aggressive and belligerent, with a return of procreative power. Though highly desirable, testicles from the young of the human species are practically unavailable, so that Voronof is using for old men transplants from the higher simian apes.

The condition of hypergonadism, with its heightening of sexual desire, leads to immoderate cohabitation and is sometimes seen in the beginning of the manic phase of the manic-depressive psychosis and occasionally it is present in a developing paresis. Another phase of sexual hyperesthesia which may be observed in some men, is where they are so persistent in the sexual demands upon their wives as to compel submission to sexual intercourse during the period of menstruation, and the state not uncommonly leads to infidelity. Where the male becomes insatiate the condition is spoken of as satyriasis, which may be a degenerate trait, when it is more properly considered under sexual anomalies. In the human subject, the psychic element is a powerful factor in the sex life of the individual. A case recently reported by me was that of a colored man, who at eighteen years had sustained a severe injury to his testicles which necessitated their complete removal. Twenty-four years later he was charged with and was convicted of the offense of

rape. Presumably, he had been fairly active sexually for the intervening years. Such could not have been the circumstance had he been castrated before puberty and had he been without the personal experience of sexual intercourse.

Eunuchoidism (Acquired).

The site of this disorder is probably in the interstitial cells of Ledig, with consequences comparable to those observed in the castrate, but in such individuals the testicles are preserved. This condition may result from accident, or through the diseases of syphilis, gonorrhea, or tuberculosis. A study of case reports shows that a variety of symptoms may be present. Sometimes the external genitalia undergo atrophy, and the bodily contour may become similar to that of the female. Sexual desire is usually lessened, and the individual may show some weakening of his physical and his mental powers.

The *treatment* of these disorders is very unsatisfactory.

Ovarian Disturbances.

It is stated that the ovaries contribute two definite internal secretions, one of which arises from the corpora lutea, and the other from the interstitial cells. The ovaries maintain an intimate association with the thyroid and a less intimate relation with the pituitary.

Hypoövarianism. This condition is at times concerned with irregular, scanty, or suppressed menstruation, perhaps sterility, with varying degrees of sexual obtundity, and in the extreme may amount to frigidity, which is an embarrassing state beset with grave marital dangers.

Hyperovarianism. Here, menstruation may be too frequent or too profuse. When sex hunger passes beyond normal bounds, masturbation may be resorted to, the individual may be insatiate—a nymphomaniac—or she may stoop to the lowest depths of degradation and become a pervert. Nymphomania at times proves a very troublesome pathological condition, since by reason of the sexual act being less exhausting to the woman, her desire and activity may

know but little abatement. Such individuals are always psychopaths and their insatiability is sometimes a feature of a psychosis, as in those who show more or less of a manic-depressive trend to their mental make-up. Women, the victims of this trait, may be given to exhibitionism. Occasionally, the disorder declares itself at the climacteric period, when it may become so pronounced as to necessitate placement in a detention hospital.

Climacteric Disturbances. The phenomena incident to the "change of life" are practically those of slight hyperthyroidism and are probably due to the cessation of the restraining activity of the ovaries upon the thyroid, but usually such manifestations are not incapacitating and subside without untoward effects. However, in those individuals who earlier in life have been subject to hysterical or neurasthenic disturbances, pronounced symptoms may appear and an actual psychosis occasionally develops, which for the most part conforms to a melancholia or to the manic-depressive type of disorder.

The common symptoms are exaggerated flushes, spots before the eyes, ringing in the ears, headache, fatigue, inordinate sweating, a tendency to faint, and an inclination toward obesity. Not infrequently, owing to a pelvic congestion, there is a lighting up of sex desire, which, however, usually subsides without special consideration but which, on the other hand, may be of such a violent nature as to require some hospital supervision.

Sometimes the condition known as "surgical menopause" results from the removal of diseased ovaries. Here the symptoms are precipitate and are said to be somewhat more severe, when, in addition to removal of the ovaries, sacrifice of the uterus has also been found necessary.

The Inflammatory Arthropathies

BY

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The Inflammatory Arthropathies.

(The Arthritides.)

INTRODUCTION.

THE inflammatory conditions of the joints have engaged the attention of the physician ever since the practice of medicine began. The earlier writers discussed practically all forms of joint diseases under the broad term of "Rheumatism." It is an interesting chapter in the history of medicine which describes the evolution of ideas in relation to joint diseases. The term rheumatism came into use on account of the early notion that disease was due to a disturbance of the flow of the fluids or elements of the body. This idea was included in the humoral theory of disease. It was supposed that there existed a catarrhal fluid or "rheum" in the brain which flowed into the various parts of the body and caused pain. Wherever, therefore, any pain was experienced which could not be explained readily by ordinary causes such as traumatism or sprain, especially if the pain was supposed to be localized in the bones and joints, it was called rheumatism. Unfortunately up to very recent times there has been this same tendency to refer to all obscure pains as of "rheumatic origin." It was early in the seventeenth century that the renowned Sydenham first differentiated between the condition of the joints caused by rheumatism and those caused by gout. From this time on the development of our knowledge of the diseases of the joints was largely in two directions. The one pointed towards infection as the chief etiological factor, the other pointed towards metabolic change as the cause of the arthritides.

The greatest impetus to, and the most convincing evidence of, the theory of the infectiousness of joint diseases was given by Cheadle in the latter part of the 19th century (1888) in his Harveian lectures upon the manifestations of the rheumatic state in children. This paper served to bring out

in great clearness the symptom complex of a disease—acute rheumatic fever—which heretofore had been confounded with the great group of the common arthritides. It was about this time that the greatest activity was evidenced by those who contended that joint affections were largely of metabolic origin. Among these were Haig and his predecessors and followers who taught that uric acid was the chief etiological factor. There can be no doubt that Cheadle and those who accepted his theories were influenced in their views largely by the new science of bacteriology which at that time was being applied to certain forms of disease. The possibility of staining and culturing microorganisms as shown by Carl Weigert and others in the latter half of the 19th century opened up avenues of research which lead direct to the problem of the arthritides. It was this vantage ground which enabled Cheadle to speak with such prophetic certainty when he said, "The occasional epidemic prevalence, the variability of type, the incidence upon the young, the occurrence of tonsillitis, of endocarditis, of pneumonia, of erythematous eruptions; the rapid anemia, the tendency to capillary hemorrhages, the implication of joints, the relapses, the occasional supervention of hyperpyrexia, the nervous disturbances, the specific power of salicylic acid, are all suggestive of an infectious disease."

This marked the beginning of an entirely different concept of the diseases of the joints. Acute rheumatic fever was looked upon as a disease due to a bacterial infection in which the joint involvement was only a part of the manifestation. The new science of bacteriology was thus called upon to aid in discovering the specific infection responsible for the disease.

The inflammatory conditions of the joints other than those associated with acute rheumatic fever were supposed to be local conditions, due either to localized infection or to certain metabolic disturbances or both.

However, with all the effort put forth since the advent of bacteriology a specific germ for acute rheumatic fever has thus far not been found. The work in this direction of Poynton and Paine in England and of Rosenow and others in this country has been stimulating but not convincing. At present the attention of investigators is directed more particularly towards the joint affections which are not so definitely as-

sociated with a systemic infection and yet are often loosely called "rheumatism." The result of all these investigations is that our ideas of joint diseases are changing. The late Dr. John B. Murphy, who was a close student of the diseases of the joints, as he was of many other diseases, was of the opinion in his time, "that the day is not far distant when the terms rheumatism and gout will no longer be employed in our nomenclature." The orthopedic surgeon, as well as the bacteriologist, is in a measure responsible for the more limited use of the term "rheumatism." Faulty posture, certain abnormalities of weight, and certain definite principles of strain have been brought to the attention of the physician by the orthopedist with the result that there are fewer cases of rheumatism diagnosed and the salicylates are less frequently prescribed, all of which again shows the transition in viewpoint up to the present in the consideration of the arthritides.

CLASSIFICATION OF DISEASES OF THE JOINTS.

In the present transitional stage of our knowledge of joint diseases it is difficult to speak definitely or authoritatively of any classification. In certain affections the lesion may begin as an *acute* process, pass gradually through a *subacute* stage, and terminate as a *chronic* process. In others the lesion may begin as a chronic or subacute affair and never show any acute manifestations.

Again in certain joint diseases the specific microörganism is apparently the *essential* and determining factor, as in tuberculosis of the joints, while in others, as in the arthritis of scarlet fever, the microörganism is only an *incidental* factor and seems to have very little determining quality as to the character of the lesion. In joint diseases there must also be taken into consideration such factors as trauma, sudden and acute, or prolonged and chronic; also the effect upon the joint of disturbances of blood and nerve supply, of nutrition and the effect of faulty posture.

With the present progress of our knowledge it appears that it may not be long until all inflammatory conditions of the joints in whatever stage will be attributed to a more or less

specific microörganism, and other factors which have already been suggested will be only considered as incidental or contributory. Until that time, however, a comprehensive classification may be given somewhat as follows:

1. Infectious arthropathies (the arthritides).

(A) *Incidental.*

(a) Occurring in connection with pyemia, septicemia, small-pox, measles, scarlet fever, typhus fever, typhoid fever, cerebrospinal meningitis, pneumonia, dysentery, diphtheria, erysipelas, puerperal fever, and influenza.

(b) Rheumatic class; acute rheumatic fever, arthritic purpura, erythema nodosum.

(c) Polyarthritis associated with focal infection, multiple arthritis (rheumatoid arthritis, going on to arthritis deformans).

(B) *Essential.*

(a) Tuberculosis.

(b) Syphilis.

(c) Gonorrhea.

2. Traumatic arthropathies.

(a) Chronic villous arthritis.

3. Static arthropathies.

(a) Flat foot, sacro-iliac strain, etc.

4. Hemorrhagic arthropathies.

(a) Hemophilia.

(b) Scurvy.

5. Neuropathic arthropathies.

(a) Occurring in connection with locomotor ataxia, syringomyelia, etc.

(b) Occurring in connection with Raynaud's disease.

6. Congenital luxation of joints.

ARTHRITIS IN THE ACUTE INFECTIOUS DISEASES.

An acute inflammation of a former healthy joint may occur during the course of certain of the well-known infectious fevers. In some, such as typhoid fever, due to a specific microörganism there may be an acute inflammation of the

joints, and yet the Eberth bacillus is rarely recovered from the joint; while in others, such as scarlet fever and measles, in which the specific microörganism is not yet known there may be a similar complication of the joints with probably even a greater obscurity as to its cause.

In other words, what definite information there is at hand as to the specific microörganisms responsible for certain infectious diseases does not in the least warrant the conclusion that the accompanying lesion in the joint is due to the same microörganism. There may be an exception to this statement in the case of an acute arthritis associated with pneumonia. In such cases the pneumococcus may be recovered from the joint tissue and not infrequently in pure culture.

The acute infectious diseases complicated with occasional lesions of the joints are in their order of frequency about as follows: scarlet fever, pneumonia, typhoid fever, influenza, and erysipelas. In some of these the joint symptoms and the appearance of the joints are much like those found in an ordinary toxemia, or septicemia, or septicopyemia. The joint lesion may resemble even that of acute rheumatic fever, but the distinguishing feature is that in all of these infections suppuration may occur and the joint may be permanently damaged, a condition which never occurs in rheumatic fever.

Scarlet Fever. The joint complication occurs usually in the latter part of the course of the infection, or during convalescence. The small as well as the large joints may be involved. Insofar as swelling, redness, and fixation, of the joint are concerned the appearance is almost the exact counterpart of rheumatic fever. However, the temperature is not so high, the pain is not so great, and there is not the characteristic sweating. Suppuration of the joints may occur, but usually the condition subsides without leaving any damage to the joint.

Pneumonia. Soon after the pneumococcus was isolated as the cause of pneumonia, Weichselbaum reported (1888) a case of pneumococcic arthritis and referred to four cases which had been cited by Leroux from Grissollis *Traite de la Pneumonie*, 1864. This was the first case that had been worked up in detail. In 1902 Herrick¹ reported four cases,

bringing the number then reported to fifty-two cases. Herrick, in his comprehensive paper, concluded that the lesion occurs infrequently, but oftener in men than in women, and is usually monarticular, the larger joints being most frequently affected. The lesion may be only in the synovia or it may be more extensive and may be highly destructive to the joint. It may occur at any time during the course of a siege of pneumonia and may also occur late in the convalescence. A pneumococcus arthritis may occur as an independent process without there being a primary lesion in the lungs. This has been demonstrated by cultures taken from the affected joints.

The writer has seen two cases of pneumococcic arthritis complicating lobar pneumonia. Both were of the knee and presented symptoms and signs of such an arthritis as may occur in the septicemia of an acute ulcerative endocarditis.

The *prognosis* in these cases is always grave. When suppuration is detected immediate incision and drainage should be done. The serous type, according to Herrick, may recover by aspiration, rest, and compression.

Typhoid Fever. The joint affections in typhoid fever may be of an acute form occurring in the height of the fever or at any time during convalescence, or of a chronic form occurring late after convalescence. The chronic form occurs more frequently than the acute, though both occur rather infrequently. McCrae² reports only eight cases in fifteen hundred patients with typhoid. The joints rarely suppurate. It usually occurs in the large joints and especially in the spinal column where it may produce rather unusual symptoms, especially in the chronic form. The writer has seen only one case in the acute form. This patient had been discharged from the hospital after a mild course of typhoid with no complications. In two weeks he was readmitted on account of a pain in the lumbar region, and with a temperature of 102° F. After ten days of rest in bed the temperature subsided, and the pain and tenderness became localized about the second and third lumbar vertebræ. A fixation cast was applied before the patient was well. In 1893 and 1894, while on duty as resident physician at the Philadelphia Hospital, it was the writer's privilege to ob-

serve two cases of chronic "typhoid spine" in the service of Dr. James Hendrie Lloyd, chief physician to the neurological wards. At that time this complication was looked upon as of nervous origin. Both patients seemed to have a definite deformity of the spine, which was bent like the half of a barrel hoop and compelled them to assume a characteristically fixed decubitus. They suffered severe girdle pains, which were interpreted as being due to certain changes in the ganglia of the posterior roots. McCrae³ reported four cases in which he demonstrated by x-ray that there was a bony change in the vertebræ. One of his cases had a paratyphoid infection.

A curious manifestation of the joints in typhoid fever is that of the hips in older people. There is occasionally a spontaneous luxation of the hip joint. This was brought to our attention by Keen. Suppuration of the joints in typhoid fever is rare.

Typhus fever is rarely associated with an acute arthritis. When it does occur it is no doubt due to an associated septicemia.

Small-pox. In this disease there may occur a polyarthritis which is likely to become purulent as in a pyemia. The elbow joints are particularly prone to be involved.

Influenza. Polyarthritis is mentioned by most writers as a common complication of influenza. There is no doubt that the incidence of joint pains and of stiffness of the joints during the attack of influenza, and for some time after the attack, is high. It is one of the cardinal symptoms. However, few patients show any evidence of acute or chronic arthritis. Among 547 acute cases of influenza which formed the basis of a report from the University of Pittsburgh School of Medicine,⁴ none had any complication of the joints. Several who had previously had chronic joint affections experienced a relighting of these processes.

Erysipelas. Acute arthritis may occur as a complication. In an analysis of 1673 cases of erysipelas by Anders,⁵ only twenty cases of acute arthritis were noted. It is evidently a rare condition.

Pyemia and Septicemia. The synovial membranes of the joints are as prone, or even more so, to become involved

as are the other serous membranes when there is a blood-stream infection from the microorganisms which are responsible for a pyemia or a septicemia. Sometimes the joint involvement is the first localized evidence of the general infection. It may have the appearance of the joint in acute rheumatic fever, but it is frequently of one joint only and the process has a tendency to go on to suppuration. The condition is usually fatal. The more chronic, or the mildly acute forms, under proper surgical treatment, frequently recover.

Puerperal Sepsis. This is not infrequently associated with an arthritis. Many joints may be involved and the condition may easily be confused with acute rheumatic fever. The literature of some years ago gives evidence of this, as more cases of "rheumatism" complicating fever were reported then than now. The arthritis is usually of a large joint as of the knee, is not so often multiple, and not so fugacious as in acute rheumatic fever. It is usually of long duration and may lead to an ankylosis. In a woman who has had a gonorrhea the process may be nothing more than a gonorrheal arthritis.

Measles. Arthritis is a rare complication of measles. Other diseases, such as *bacillary dysentery* and *cerebrospinal meningitis* are also characterized by the infrequency of such a complication.

ACUTE RHEUMATIC FEVER.

This is an acute infectious disease of unknown origin, characterized by a more or less rapidly migrating polyarthritis, accompanied by a characteristic fever and associated frequently with an acute endocardial or myocardial change, or both. It is largely a disease of childhood and early adult life. In fact it was first definitely differentiated from the group of the ordinary arthritides by the distinctness of its symptom complex as manifested in children (Cheadle). It is a disease which is always present, but seems to be more frequent in certain years, and especially in certain months of the year. These are the late winter and the early spring months. It is also supposed to flourish in damp places

and in climates where sudden changes of temperature are likely to occur. It is therefore largely a disease of the temperate zone.

INCIDENCE.

On account of the difference of opinion with reference to the nature and cause of the disease, statistics vary greatly. Also because the disease occurs more frequently in some years than in other, and because it seems to be less frequent in those years when great epidemics (such as influenza) occur, it is difficult to obtain dependable statistics. According to Lambert,⁶ who reviewed the Bellevue Hospital statistics from 1906 to 1919, the highest percentage of cases of acute rheumatic fever was in 1907, when 2.45 per cent. of 28,789 of the admissions to the hospital, or 706 patients, were thus afflicted. The lowest percentage was in 1919, when 0.521 per cent. of 37,632 of the admissions, or 190 patients, were thus afflicted. In the Mercy Hospital, Pittsburgh, among 9230 admissions, from June, 1920, to June, 1921, there were only thirty-three cases of rheumatic fever. These constitute about 0.36 per cent. of the admissions. In the Columbia Hospital, for the same year, among 3184 admissions (of which 693 were medical cases) there were only three cases. In both hospitals the incidence was even less during the years of the epidemic of influenza, 1917 and 1918. It is thus seen that acute rheumatic fever cannot be said to occur frequently, especially in hospital practice. In a family and consulting practice outside of the hospital the writer has seen only fifteen cases among about 23,000 patients suffering from all forms of disease. In all the statistics consulted, three rather interesting points were noticed: *First*, the disease does not occur frequently; *second*, it varies in incidence in the different years; and *third*, it seems to occur even less frequently during years in which there is an epidemic, as for example during the influenza years.

ETIOLOGY.

The specific cause of acute rheumatic fever is not known. It is as much of an enigma from the standpoint of its bacteriological origin as typhoid fever was almost one hundred

years ago, or when it was first differentiated by Louis and his pupils from typhus fever. No definite microörganism has yet been isolated which will meet the postulates laid down by Koch as being absolutely necessary before any germ can be designated as specific for a certain disease. The work begun some twenty years ago by Poynton and Paine at first seemed convincing but according to most bacteriologists it has not stood the test. The "*Streptococcus rheumaticus*," so called, does not receive the same consideration from the clinicians now that it did fifteen years ago. During the past ten years fresh impetus has been brought to the study of acute rheumatic fever as well as to diseases of the joints in general by the epoch-making work of Billings and Rose-now, from the standpoint of the so-called focal infections. And while the clinic and the laboratory have been greatly impressed with the apparently definite relation of infection, especially focal infection, to the inflammatory joints and other conditions, no specific microörganism has been found for acute rheumatic fever or for the arthritides in general.

The conclusions of Swift and Kinsella,⁷ of five years ago, still seem to obtain, though an enormous amount of work has been done since their publication. They are as follows:

1. Cultures from the exudate aspirated from the joints in acute rheumatic arthritis have been uniformly sterile.
2. Non-hemolytic streptococci have been recovered in blood culture from less than ten per cent. of patients suffering from acute rheumatic fever.
3. Similar streptococci have been recovered from the active endocardial lesions in only half of the fatal cases of acute rheumatic fever.
4. From the above results it seems evident that no type of streptococci has been constantly associated with acute rheumatic fever.
5. We do not feel that the etiologic relationship between the streptococcus and acute rheumatic fever has been definitely proved, but if the streptococcus is the etiologic agent in acute rheumatic fever, it is shown by means of cultural and immunologic studies that it is through various members of the viridans group, and hence no one member can be called the *Streptococcus rheumaticus*.

The search for the specific microörganism, though it has not resulted in positive findings thus far, has stimulated the clinician to a more careful study of suspected cases of acute rheumatic fever and the outcome is that diagnoses are made more carefully and the incidence, probably for this reason alone, is not so great. On the one hand, the cases of acute endocarditis which may be associated with mild joint pains, and pains from thrombi anywhere, are definitely classed as acute ulcerative endocarditis, and not as acute rheumatic fever as was previously the tendency; and on the other hand, cases of polyarthrititis, subacute or chronic with acute exacerbations, are not so frequently diagnosed as acute rheumatic fever as in the past. Until recently statistics have been unreliable. It has been suggested by Lambert⁶ that the apparent decrease in the incidence of this disease is due to the greater care which is now given to the teeth and tonsils and other possible foci of infection. This may be so, but the writer is inclined to believe that the more careful study of diseases of the joints on account of influences brought to bear by the pathologist and the bacteriologist as well as by the orthopedist, has developed a greater diagnostic skill and care, and that acute rheumatic fever is really not as frequent as it was formerly thought to be.

Notwithstanding the negative results in the study of the causes of acute rheumatic fever, there is a general belief that a definite microörganism exists which is responsible for the disease.

The writer is fully convinced of this, even though his many careful blood cultures made in undoubted cases of acute rheumatic fever have all been negative. This has been the experience of many other clinicians, of which the literature bears abundant evidence. It has always been a question upon which there has been a diversity of opinions, as to how the microörganism, whatever it may be, gains access to the body. The general belief is that it enters the blood-stream through an acute local infection somewhere in the upper respiratory tract. This infection may be so mild as to escape attention or it may be so severe as to obscure the early evidences of an acute rheumatic infection. The tonsils and sinuses are frequently involved in such a local in-

fection and form apparently the starting point of the general infection.

The organisms isolated from such foci have produced joint diseases—polyarthrititis, and also endocarditis in the lower animals—but this is not definite proof that they cause acute rheumatic fever.

No doubt the reason for the almost universal belief that acute rheumatic fever is due to a specific microörganism is that it is in accord with the course of acute infectious diseases in general. But there is a wide difference between declaring a disease as being of specific origin from a clinical standpoint and designating a specific microörganism acceptable to the bacteriologist as the only cause of that disease.

Acute rheumatic fever occurs more frequently in the male than in the female. It is no longer considered so strictly an hereditary disease. This again is no doubt due to the fact that the clinical conception of acute rheumatic fever is becoming more definite, being definitely differentiated from gout and other joint affections which seem to prevail in families.

The character of the diet has very little affect upon rheumatism from an etiological standpoint. It is largely a disease of the temperate zone and where sudden changes of temperature are likely to occur. It seems to occur more frequently when there is a state of subnutrition or of mental strain. If to these are added exposure to cold and wet, practically all the conditions necessary for the onset of an acute infection are present.

A previous attack is always conducive to recurring attacks. There is apparently no immunity established. Subsequent attacks are, however, often not so severe as the initial attack.

MORBID ANATOMY.

The most characteristic lesion of acute rheumatic fever is in connection with the serous membranes of the joints. The synovial membranes and the sheaths of the ligaments are generally also involved. The synovial fluid becomes turbid but never is purulent. Another striking characteristic is that during the convalescence, the reddened and swollen joints resume their normal color and contour, leaving ap-

parently no trace of the profound infection. After repeated invasions, however, the joints may become somewhat impaired. The endocardium, especially of the mitral valves, is frequently involved. The pericardium, the myocardium, and the coronary arteries, also may show changes due to the profound infection, or to repeated mild infections.

When the endocardium is affected the lesion is usually of a vegetative nature located at the extreme edge of the valve leaflets. In its location it differs from that of syphilis and other infections which commonly produce a sclerosis at the base of the valve leaflets. In a case followed by the writer to autopsy this difference was strikingly demonstrated. There was a positive Wassermann and the lesion was apparently at the aortic orifice, and was supposed to be due to lues. At autopsy luetic plaques were found in the arch of the aorta and there was a definite sclerosis at the bases of the aortic leaflets, evidently of a luetic origin, *but the edges of the valves contained fresh vegetations from which a pure culture of the viridans group was obtained.* There may also be changes in the wall of the aorta, of an inflammatory nature, as was observed by Klotz.⁸ He calls attention to the pathological lesions in the case of a six-year-old boy with acute rheumatic endocarditis, in which he found at autopsy a saccular aneurism of the ascending arch of the aorta. According to his observations the lesion is usually in the outer portion of the media and adventitia.

Death due to rheumatic fever is most frequently a cardiac death, but it occurs many years after the acute infection has spent itself. The mechanical difficulty under which the heart must perform its function after valvular lesion has been established leads to well known myocardial changes. But these myocardial changes may also occur in later years, long after the acute infection is spent, independent of endocardial and pericardial lesions. This may be explained by a latent subinfection of the myocardium direct. This is of extreme importance and should always be reckoned with when considering the prognosis of a case which presents no evidence of valvular lesions but in which there is a history of previous attacks of acute rheumatic fever. Hence, while the interest and concern of this disease in childhood lies largely in the

direction of diagnosis, in adult life or in old age it lies decidedly in the direction of prognosis.

The *lungs* are rarely involved in acute rheumatic fever, except as they are affected secondarily by the changes due to cardiac insufficiency. The *pleura* may be involved occasionally, as serous membranes elsewhere are affected. An effusion into the pleural cavities is occasionally found.

The *kidneys* do not give evidence of any specific changes except such as may be found in cases of pyrexia ordinarily. Later changes resulting from a chronic endocarditis due to acute rheumatic fever are not a part of the acute rheumatic infection.

It is rather interesting to note that the so-called "rheumatic iritis" occurs very seldom during an acute attack, and often the history of a definite attack of acute rheumatic fever cannot be obtained.

Certain *subcutaneous nodules* found especially in children suffering with acute rheumatism are supposed to be definitely characteristic of this disease. In older individuals this lesion may not appear at all. Histological examination of these nodules reveals a mass of spindle shaped and round cells. Nodules similar to these may be found in migraine, in chronic polyarthritis, and in gout. They are therefore not pathognomonic signs of acute rheumatic fever. Similarly there may also be found certain cutaneous manifestations. These are the various forms of erythema—marginatum, papulatum, and nodosum. Rheumatic purpura is a striking skin manifestation which is always looked for and when it appears is usually considered as evidence of the gravity of the disease. These also may be found in various other infections, especially in acute ulcerative endocarditis, or in blood-stream infections. The writer recalls a striking case of posterior urethritis of Neisserian origin which developed into a so-called gonorrheal arthritis of acute form. Before the patient died there appeared an intense purpuric rash, beginning in the region of the right shoulder and finally, just before death, covering almost the entire body. These skin manifestations are also found when there is no evidence whatsoever of a systemic infection. Erythema nodosum usually occurs along the spine of the tibia and on the forearm and

dorsal surface of the hands. It usually is accompanied with severe localized pain which may have no relation with the joints.

SYMPTOMATOLOGY.

The onset may be abrupt and sudden, accompanied by a decided chill. This is followed by a fever, and finally by pain in one or more joints. Redness and swelling with immobility of the joint soon appear, and this sequence passes from joint to joint until every joint in the body may become involved. The distribution is not symmetrical. The pain is severe to the extent of producing a helplessness amounting almost to a paralysis. The process may subside in a joint and later during the same attack there may be a recurrence in the same joint. When the disease has run its course the joints are left intact without any ankylosis.

The temperature does not run a definite course. It may be of a hectic type. The height of the temperature furnishes no evidence of the severity of the attack. With the elevation of the temperature there is usually a profuse sweat. This at first is sour smelling and produces a characteristic "rheumatic odor." The pulse rate rises and falls with the temperature. It varies also with the extent and severity of the complications of the heart. As the disease progresses the patient becomes pale. This pallor is not always, especially in the early stage, accounted for by an actual anemia, for the hemoglobin and the erythrocytes may not be particularly lowered. The leucocytes are increased to 12,000 and 14,000 or more per cubic millimeter, the increase being largely in the polymorphonuclears. The pallor early is due to the intense pain, the consequent loss of sleep, and the profuse perspiration. Later in the disease there may be a marked secondary anemia. Blood cultures, as stated before, are almost invariably sterile. The urine is concentrated, as one would expect it to be in a febrile disease with profuse perspiration. The evidence of a nephritis is rarely present.

The course of the disease is usually over a term of weeks or months rather than days. One attack does not establish an immunity; on the other hand, the patient seems to be rather predisposed to subsequent attacks. After an attack

there may occur, in a short period of time, another attack, mild or severe.

COMPLICATIONS.

Next to the serous membranes of the joints the heart is most commonly affected. Endocarditis, especially at the mitral orifice, is the most frequent lesion. The aortic orifice may occasionally be infected, and this should always be kept in mind when dealing with an aortic lesion. The usual interpretation of aortic valve lesion is that it is of luetic nature. Considering the frequency of rheumatic endocarditis as compared with syphilitic involvement of the heart, it can be said that a rheumatic lesion at the aortic valves is not infrequent. While the lesion is acute, it is, after all, different from the condition found in acute ulcerative endocarditis—"malignant endocarditis." From acute rheumatic fever the patient usually recovers, though with a damaged heart; from ulcerative endocarditis there are few, if any, recoveries. Rheumatic endocarditis occurs most frequently in children, but it is surprising how often it produces only a slight change of the heart in the course of the fever, is apparently recovered from, and is not considered to have been of any consequence until in adult life when there appears a cardiac decompensation. Often also in the course of a general examination, as for insurance or for military service, a cardiac lesion may be unexpectedly found—the evidence of an endocarditis which occurred years before.

The *pericardium* is frequently involved, particularly in children and in early adult life.

The *myocardium* is probably also involved at the same time but the evidence of its presence and extent is not so marked until in later adult life.

Chorea is occasionally present, especially in children, and it seems to occur more frequently when the rheumatic attack is mild, or sometimes long after the acute attack. It is not uncommon for chorea to appear in a child as the first recognized evidence of a rheumatic infection. The history of such a case may bring out the first intimation that a previous sore throat or that previous vague pains have been experienced.

Severe *headache* is sometimes experienced and may become a serious complication. It is more likely to occur when there is a hyperpyrexia. Occasionally this is the forerunner of cerebral disturbance such as *coma* and *convulsions*.

PROGNOSIS.

The disease is rarely fatal, and yet in its complications it may bring about certain conditions which definitely shorten life and determine the cause of death. This is especially true in those cases in which endocarditis has been a complication. Because it is the most frequent cause of simple endocarditis, the prognosis, while good for the immediate attack, may after all be relatively bad. There has been no death in the past five years from acute rheumatic fever at either the Mercy or the Columbia Hospitals, with an average annual admission of over 12,000 patients suffering from all conditions and diseases.

DIAGNOSIS.

This is usually not difficult, especially if it is an acute case and if there is the history of a preceding slight sore throat, of exposure to cold and wet, and of previous attacks. The symptom complex which is almost pathognomonic is as follows: Sudden, rather severe pain in a joint with redness and swelling, the same process in the course of a day or so in other joints, rarely symmetrical, high fever, rigor, rapid pulse, acid sweats, subsidence of the symptoms with the administration of the salicylates, followed by great prostration and a return of the joints to the normal. To this combination of symptoms there may be added, in nearly half the cases, those of an acute simple endocarditis.

It is necessary to differentiate from an *acute polyarthritis*, also from *arthritis due to infectious fevers*, and from *gonorrheal rheumatism* and *simple pyemia*, or septicopyemia. These joint conditions are discussed more definitely under their separate heads, but it may be said in a general way that in none is the general systemic infection so evident as in acute rheumatic fever. The pulse and temperature are not so high, there is not the same tendency to sweating, and

the joints (which are affected symmetrically) tend to show permanent deformities.

Acute rheumatic fever has been considered by some as a form of *pyemia*. The two conditions have, however, very little in common. In *pyemia* there is a septic focus in an active state with apparently no wall of defence about it to protect the healthy organism. The absorption is direct into the blood-stream or from the lymphatics into the blood-stream, and multiple secondary foci originate. These are not distributed particularly in relation to the joints, but may occur anywhere, especially in the liver, the lungs, and the pericardium. The secondary foci are purulent, and the condition is rapidly fatal.

It may at first be difficult to differentiate from an *acute ulcerative endocarditis* with septic emboli, especially if these occur in or near the joints. These emboli may occur in any part of the body but are not as likely to occur in the large joints. They frequently occur in the spleen, leading to enlargement which is uncommon in acute rheumatic fever. The courses of the two diseases are entirely different, in one there is recovery, in the other death. It should not be difficult to differentiate from *arthritis deformans*, and yet in the early stages, the polyarthritis, with the occasional flare-up of a joint, may be for a time confusing. Acute rheumatic fever leaves no deformities and does not lead to ankyloses.

There should also be no difficulty in differentiating from *gout* because of the peculiar constancy of the location of the lesion in the great toe, and because of the age and the absence of the characteristic fever and sweats.

TREATMENT.

This resolves itself into prophylactic and curative measures.

Prophylaxis. The prophylactic treatment of acute rheumatic fever is of the utmost importance. When the disease has once begun, comparatively little can be done to change its course or to prevent the grave complications. The immediate comfort of the patient is then the chief concern. Complications may arise regardless of how great the care exercised, so also may recurrences occur regardless of every precaution.

The prophylactic measures to be instituted are as follows: The individual should be warmly clad, and should avoid being chilled when there is changeable weather. The feet and ankles should be kept warm and dry. There are certain damp localities in which people live and work which should be avoided if possible. Overeating should be avoided, and the bowels should be kept regular. The patient should drink plenty of water. If the patient has a tendency to take cold, he should have the upper respiratory tract carefully examined by a competent nose and throat specialist. If the tonsils are diseased, or only "suspicious" of disease, they should be enucleated. Also infected sinuses should be looked for and cleaned up. Other foci of infection should receive the same consideration, but the *tonsils* should receive particular attention. By following the above directions, in many cases the attacks may be avoided. There is as yet no specific vaccine against the disease, but should one eventually be discovered the same prophylactic care will, no doubt, still be necessary.

Active Treatment. After the disease has once begun, the patient should be put to bed immediately and kept there until the temperature has been normal and the swellings have subsided for at least two weeks. There should be no exception to this. Patients might be allowed to get up sooner providing there has been no evidence of heart complication, but sometimes the heart sounds seem normal for a considerable time after the temperature has subsided and later the evidence of an acute endocarditis may appear. The patient should be kept warm and the joints handled or moved as little as possible. Sometimes fixation of the joint with a light, easily removed splint, gives great comfort. The desired warmth may be obtained by putting the patient between blankets, and applying hot-water bags or electric pads. Woolen bandages or raw wool should be applied to the joints. The nightgown should be changed frequently when there is profuse sweating. Application of medication to the joints is of little value. The liniments which have been used are valuable largely for the amount of alcohol they contain and for their soothing and convincing odor. Frequent general warm alcohol rubs are agreeable during the

height of the fever. The local application of a hot pack of a saturated solution of sulphate of magnesium, or of normal salt solution, or boracic acid solution, is agreeable, especially if the pack is firmly applied and covered with oiled silk or waxed paper. It is doubtful, however, whether more is gained from such applications than the warmth and fixation which they afford to the joints and tissues. The joints should be protected from the weight of the heavy bedding by suitable supports. Massage is harmful in the early stage of the disease; later it may afford considerable comfort to the patient if it is properly administered. The rubbing and kneading should not be so vigorous as to produce pain, and it should not be accompanied by Swedish movements. In fact there is such a danger of delaying recovery by too vigorous massage that it is safer not to use massage at all.

Medication. When the diagnosis is once made there is nothing gained by allowing the patient to suffer pain for want of proper and sufficient medication. The salicylates are almost a specific for this condition. They should be given at once and in *large* doses. Sodium salicylate is the preparation most frequently given. Other preparations, such as salicylic acid or strontium salicylate, may be given, but they possess no advantages over the old reliable sodium salicylate. It can be given in from ten to twenty grain doses by the mouth, dissolved in a glass of water, every two hours, until the pain is relieved and the temperature is normal. The contraindications to this medication are, tinnitus aurium, gastric intolerance, and kidney irritability. The first two are fortunately not frequently met in severe cases. It seems that the patient who does not have the severe pains, for which the salicylates are often used in a rather desultory way, is most likely to experience tinnitus or gastric irritability. The writer has seen many patients who have attributed certain gastric symptoms to the use of salicylates for "rheumatism."

Almost invariably it was found that the patient had not been confined to bed, had had no temperature, or redness and swelling of the joints, and had not taken large doses. Whereas the patient with a real severe attack after the

prolonged use of large doses rarely complains of gastric disturbances.

As stated before, the evidence of kidney irritation is not so great in this disease as in other febrile infections, such as typhoid, for example. Even with the large doses of salicylates the writer has not seen any greater incidence of albumin, casts, or blood, than is found in typhoid fever, nor has the subsequent history of his cases shown the evidence of kidney injury. Some of the cases in which large doses of salicylates had been prescribed have been followed for nearly twenty years with no evidence of nephritis.

It is necessary for the patient to take large amounts of water when the salicylates are taken. Sodium bicarbonate is usually given in conjunction with the salicylates. No satisfactory reason has yet been given for this combination. It may be that it helps to prevent or to overcome an acidosis. It has been said of the renowned clinician and author, Dr. Robert Bartholow of Philadelphia, that he declared he cured his patients by giving them lemons and oranges freely. It is possible that these had the same effect as bicarbonate of soda, or even a better effect, in overcoming the acidosis which accompanied the high fever so often associated with acute rheumatism. It seems that the patient is able to take larger doses of the salicylates and with greater comfort when bicarbonate of soda is added. The salicylates may be given per rectum, if the stomach is intolerant, but this is very seldom necessary. The action of the salicylates in acute rheumatic fever is not known. It is generally accepted that the salicylates are our best—probably our only—intestinal antiseptic, but whether this action is on the bowel content or indirect through stimulating biliary secretion, is not definitely known. It may be that the intestinal tract plays a greater rôle in the causation of acute rheumatic fever than is at present known, and it is possible that this effect of the salicylates upon intestinal content may be the reason for its well known value in acute rheumatic fever.

In very severe cases the action of the salicylates may not be sufficiently prompt to secure the desired results.

Under those circumstances a hypodermic of morphin may be given from time to time in addition to the salicylates. If only to induce sleep, morphin should be given.

Occasionally a case is found which will not be affected by the salicylates, even in large doses. In these the writer has used successfully cinchophen, a preparation which has been on the market for a long time under the trade name of "atophan." Atophan, when first introduced, was strongly recommended as a uric acid eliminant. It has been used largely in gout and in the gouty diathesis. According to some authors it has an irritating effect upon the kidneys. In the writer's experience with cinchophen he has not been able to determine that it has any deleterious effect upon the kidneys, or an effect different from that of the salicylates.

Hanzlick and his colleagues,⁹ in a clinical study in which cinchophen and other remedies were compared with the salicylates as to the therapeutic efficiency, concluded that their therapeutic effect is about the same, the toxicity of one is no greater than of the other, and that the renal injury is somewhat less after cinchophen administration than after the salicylates.

Other medication than that which has been mentioned is of very little value. The iodides are given at times, but unless there is that condition present in which the iodides are indicated, namely, lues, they will be of no value. On account of the anemia which usually accompanies or follows the attack, iron and arsenic in various forms may be given. The preparation of arsenic in the form of cacodylate of sodium is satisfactory in the convalescence of these cases. It can be given in three-fourths of a grain or three or five grain doses, intramuscularly, every second day for twelve to sixteen doses. It is particularly necessary to watch carefully for the evidence of arsenical poisoning when administering the remedy in this way.

Other measures, such as vaccines, and foreign proteins, may be mentioned only to remind the reader that they are of no value in acute attacks and their indiscriminate use may do harm. In considering joint affections, such as polyarthritis, especially chronic, these preparations will be discussed.

It has already been suggested in the consideration of prophylactic measures that foci of infection, such as diseased tonsils, should be removed. The question arises, should these be disturbed during the height of the infection? Two dangers are confronted when considering operative treatment: *First*, the danger from the operation itself, the anesthetic, and the nervous shock. These are factors which are of greater or less importance, depending upon the individual case. It is a question of judgment after all the available facts are in hand. *Second*, the effect upon the course of the general infection when a focus is disturbed. This can scarcely be determined beforehand. It is the opinion of the writer, from a large experience in dealing with foci of infection in the chronic arthritides, that to disturb such a focus in an acute stage is hazardous.

After the acute infection has subsided the course to pursue is a very plain one, that is, all questionable foci should be cleared up so as to prevent, if possible, a recurrence. This is as necessary in the adult as it is in children.

The question often arises as to what can be done specifically to prevent the grave complication of acute endocarditis. One can truthfully say, insofar as our knowledge of the disease goes, nothing more can be done than what has already been mentioned in a general way. However, one point cannot be overestimated and that is the importance of absolute rest during the attack and of prolonged modified rest during convalescence. The rest should be begun as soon as the slightest temperature is detected, or the slightest joint disturbance is noticed.

Diet. The dietetic measures which should be established in the treatment of acute rheumatic fever are practically those which obtain in the treatment of other infectious diseases accompanied with fever. The diet should be liquid at first, and later—with improvement—semisolid, light, and later, full diet. The caloric value of the diet should be kept as high as possible. In this way complications and prolonged convalescence may be avoided.

On account of the confusion which exists in the use of the term "rheumatism" especially in its relation to gout, there is a great tendency to deprive patients of such ordinary

food as goes to make up the bulk of the calories of a daily ration. Some will proscribe one class of foods, such as the citrous fruits; others another class, as the carbohydrates, and still others the highly nitrogenous foods. If the physician is not aware of this, the patient soon will realize that he really has nothing upon which to subsist. The indication for high caloric feeding is as definite in the acute stage of rheumatic fever as it is in typhoid fever, and the results are as satisfactory. After the fever has subsided the patient should be on a light diet such as is indicated in convalescence, but the caloric value of the diet should be maintained at a high level. When the patient becomes ambulatory, a full, well balanced diet should be prescribed, and a good state of nutrition established so as to raise the resistance against any future infection. It goes without saying that the patient should be induced to drink water freely at all times, a matter which is of great importance but is frequently neglected.

ARTHRITIS DUE TO CHRONIC INFECTION— POLYARTHRITIS.

Multiple Secondary, Including Rheumatoid Arthritis and Arthritis Deformans.

This is an affection of the joints characterized by rather sudden and repeated acute or subacute inflammatory reactions occurring symmetrically which may result in a more or less permanent disturbance of function of the joints on account of the associated pain and swelling and the resulting deformity. The disease process may involve all of the tissues which constitute the joint. The soft tissues are affected first, beginning in the synovial membrane. It is entirely distinct from acute rheumatic fever, which is rarely, if ever, followed by permanent swelling and deformity. It may, however, be a sequel of repeated attacks of acute rheumatic fever and in this way produce a confusing picture. The distinction between arthritis due to a chronic focal infection—multiple arthritis or rheumatoid arthritis—and arthritis deformans, so-called, is not so definite as is the distinction between it and acute rheumatic fever. In fact it is some-

times quite difficult to differentiate between the two chronic conditions, and it seems to be the present trend of opinion that the difference lies only in the extent and chronicity of the lesion. Arthritis deformans will therefore be considered only as an advanced or unusual stage of polyarthritis, and the term "rheumatoid arthritis" will be dropped as obsolete.

The arthritides due to chronic infection, of course, do not constitute a disease in themselves; they are only the evidence of an infection which has gained access to the body somewhere and has localized at one or more definite points. While not a disease as such, the condition has so many points in common with systemic disease, that one may refer with considerable reason to its etiology, incidence, pathology, symptomatology, diagnosis, and such other elements which go to make up a disease picture.

ETIOLOGY.

The cause of this condition, as its name indicates, is a chronic infection due to certain microorganisms or types of microorganisms which have in some way gained access to the body tissues. There are no specific microorganisms, but a streptococcus or a staphylococcus, with its various strains, is most frequently suggested.

Predisposing Causes. Certain *predisposing* conditions usually combine to determine the incidence, locality and the extent of the joints involved. Among these are:

Age. It is largely a disease of middle life and of old age. In this respect it is in marked contrast to acute rheumatic fever, which is a disease of childhood, or youth, or early manhood. While the foundation of the condition may be laid in early life, the manifestation in the joints comes in later life. It is the "*rheumatism*" of the old man, and unfortunately is too often looked upon and treated as rheumatism. It is probably the most frequent and deciding factor which marks the advance of age, for it is often responsible for the beginning of the unsteady gait, the stooped shoulders, the lack of agility, the awkwardness of movement in general, and the disappearance of the freshness of vigor and health which otherwise might continue through middle life.

Sex. The incidence in males and females is about the same. In one hundred and ninety-two private cases of which the writer has records, however, there were eighty-one males and one hundred and ten females. It is possible that the greater frequency of infection of the pelvic organs in women will account for at least some of this difference. Hospital statistics as a rule are not reliable in establishing the incidence of disease from the standpoint of sex, because from the nature of things there are usually more men than women in a general hospital. Women will be more likely to take care of themselves when they are taken with any sickness, while men promptly seek the hospital.

Heredity. There is apparently considerable ground for concluding that arthritis is hereditary. If it can be considered as such, it is very likely because certain conditions which seem to be large factors in the causation of a polyarthritis are more frequently found in certain families than in others. Among these conditions is particularly that of hyperplasia of the lymphatic tissues, such as the tonsils and certain glands in the genitourinary and the gastrointestinal systems. This tendency seems peculiar to certain families and is carried from generation to generation. Certain habits of eating and drinking, as well as of body hygiene, conducive to local or systemic infection, are no doubt carried from generation to generation and in this way the condition may appear to be hereditary. It is not the disease but the tendency towards the disease that is transmitted.

Climate. Like acute rheumatic fever it is a disease apparently more common in the temperate zone, though there are no statistics which directly bear this out. Sudden changes in temperature which characterize the climate of the temperate zone and are conducive to colds no doubt are also responsible for fresh infections of the joints and for acute exacerbations of previous infections.

Occupation. Individuals who are exposed to dampness and cold are particularly susceptible to joint affections. The writer has seen a number of patients who entered the hospital suffering from polyarthritis, who gave their occupation as mining engineers, "pit bosses," or "coal diggers." Individuals thus employed experience sudden changes of tem-

perature when they pass from the warm atmosphere of the coal pit to the outside atmosphere; especially is this true in winter time. The coal miners in particular who do heavy labor in the pit, causing considerable perspiration, are inclined to wear thin clothing while working, and later when they emerge from the mines thus scantily clad they are susceptible to infection. The joints affected in these cases are more frequently the large ones, such as the knees, the hips, the shoulders, and the lumbar spine. This is due very likely to the fact that the coal miner usually works in a stooping or crouched position, because of "shearing" and undermining, and because many times the drift is low, necessitating constant stooping while working. Men who work in places of excessive heat, such as before blast furnaces or in steel mills, where frequent "shifts" are made, are likely to suffer from joint diseases.

Nutrition and Hygiene. It might be concluded from the above description that heavy physical work is the larger factor in determining the incidence of the arthritides. Such is, however, not the case. The writer has seen a large group of individuals not engaged in physical labor who seemed to have brought on the lesions apparently as the result of under-nutrition, mental strain, and bad hygiene. This is particularly true of a certain class, such as college students, clerks, secretaries, telephone operators, and others. A college student who is "working his way through" will often deny himself both sufficient food of a wholesome quality and variety and the proper amount of exercise, thus diminishing his body resistance until an infection, which otherwise might be of little significance, occurs and an arthritis is the result. Not the least factor in such an instance is that of worry on account of the uncertainty of success in class work, student life, and life as a whole. These individuals rarely allow themselves vacations or that diversion which is necessary for healthful existence.

The lack of proper nutrition and of sensible hygiene is not always the result of the want of sufficient means to provide them. The patient afflicted with arthritis not infrequently makes a diagnosis of his own—it is usually "rheumatism"—and places himself upon an unnecessarily rigid

diet, and a taxing régime, leading to subnutrition and loss of general health. It would be of inestimable value to any community if sufficient propaganda could be put forth to teach people that neither acute rheumatic fever, nor polyarthritis of any type are nutritional diseases. This will be discussed more fully in the treatment of the disease under consideration.

Traumatism. The relation of traumatism to diseases of the joints is of considerable importance. Whether traumatism without a secondary infection can of itself produce a lesion of the joint which can be rightfully called an arthritis, is an open question. It is of more than academic interest. An injury of a joint may be of such a nature as to carry with it into the deepest structures the elements of infection which, under favorable conditions, may go on to a stage of complete ankylosis, entirely disabling it. This is, however, not the kind or degree of traumatism in mind when discussing the relation of traumatism to diseases of the joints due to chronic infection. The traumatism considered as etiologic may be looked upon as of two different forms. The first is that which may be sustained from without, or externally, without such a break of the integument as might lead to a local infection. The second is such traumatism as may come from within, as by faulty posture or by other improper use of the joints. In both of these conditions the infecting organisms must necessarily already have been present in the joint tissues. Its relation to the disease process is the same as though no traumatism had occurred. The infecting micro-organism lies dormant, as it were, in the tissues, ready, however, for the conditions to arise which favor its propagation. It is the "latent infection" described by Adami.¹⁰ "For months, and it may be for years, pathogenic bacteria may persist in the tissues or cavities of the body, setting up no disturbances, but capable at any moment of doing so." Or the traumatism may light up a "subinfection," also described by Adami and McCrae as indicating "a slight degree of infection, such as is expressed by the presence of bacteria in the blood, which are not potent enough to cause gross symptoms of infection, yet which do actually wear out the cells whose duty it is to combat with and kill them."

A good example of the effect upon the lesion of traumatism *from without* may be seen in the early stages of a polyarthritis beginning in the hands and wrists. Almost always the joint lesions of the right hand are more advanced than those of the left. This is without doubt because the right hand is used more than the left and sustains the brunt of the traumatisms which go with the ordinary use of the hands. In a left-handed individual the opposite condition maintains. The writer has under his care a patient suffering with a chronic arthritis who, in his work as a wood carver, uses a chisel which he pushes into the wood by applying violently the palm of his right hand to the handle of the chisel. The metacarpal joints of the right hand are considerably enlarged while those of the left are only slightly enlarged. His teeth and tonsils are infected.

A good example of the effect of traumatism *from within* may be noted most any time in the obese individual whose weight is out of proportion to the bony frame, and who has a chronic infectious arthritis especially of the knees. The lesion in the knees is almost always advanced out of proportion to that in the other joints. The more the patient is on his feet the more marked is the difference. This comes from the constant traumatism to the tissues of the joints consequent upon walking.

It is not an unusual occurrence for a patient to have received a blow on a joint which has resulted in giving no immediate inconvenience other than that from the local contusion. Some years later, however, when a focus of infection occurs, this same joint which had been apparently normal will be the first to give evidence of inflammation.

Exciting Cause. In the discussion of the etiology thus far it is plainly seen that the predisposing causes are of themselves not sufficient to account for the lesions associated with a multiple arthritis. There is abundant evidence to lead one to conclude that a *common exciting cause must be present*. The general opinion is that this is of bacterial origin. But attempts made thus far to isolate a specific microörganism which is common to these infections have been singularly unsuccessful.

The work of Poynton and Paine—about 1900 and thereafter—in attempting to isolate the specific microörganism of acute rheumatic fever, has formed the basis of investigation for the arthritides in general. They described a microörganism in the form of a small micrococcus, one-half micron in diameter, which usually grows in pairs or in short chains. It does not show any capsule, as a rule; it stains readily with analine dyes, and it retains Gram's stain but not with great tenacity.

They gave it the name of "*Streptococcus Rheumaticus*." It was isolated from undoubted cases of acute rheumatism and was found in the most important human lesions. These investigations of Poynton and Paine have had a far-reaching effect, even though now—after twenty years—their conclusions are not generally accepted. The early attempt at recovering and identifying the microörganism was to isolate it direct from the lesion in the joint. Later it was attempted to recover the microörganism from the blood—"Net it out of the blood-stream" (Mayo, Wm. J.). More recently the attempt has been made to identify the microörganisms obtained from certain foci of infection with the microörganisms obtained from the joints of the same case. The work of Billings and Rosenow has been developed largely in the latter direction, and has compelled renewed effort from both the laboratory investigator and the clinician. In this work Rosenow has come to the rescue of the microörganism proposed by Poynton and Paine with the theory of "mutation" or "selective affinity." He developed a technique with which he was able, it seems, to obtain cultures from blood and from tissues where before he was unsuccessful. In addition he modified the aërobic and anaërobic conditions of his cultures with varying grades of oxygen tension, so as to offer the microörganism every facility for growth which it enjoys in the suspected focus.

In his article on "The Etiology of Acute Rheumatism," Rosenow¹¹ concludes with the following words: "The name *Streptococcus rheumaticus* may be retained at present, not with the idea that the organisms so-called always produce rheumatism, but rather to call attention to the fact that when streptococci produce the symptoms and lesions of

rheumatism they have certain special features which streptococci from other sources do not usually have.

"The affinity for joints, endocardium, pericardium, and often also myocardium and muscles, which characterized these organisms when first isolated, tends to disappear on cultivation. It may be restored by animal passage, and other strains of streptococci under certain conditions may be made to acquire the features of the strains from rheumatism. When the rheumatic strains have acquired the cultural features of hemolytic streptococci they lose the affinity for the endocardium and pericardium, and acquire even a greater affinity for the joints. When they have been converted into pneumococci of a certain grade of virulence, pulmonary hemorrhages and pneumonia are commonly formed after intravenous injections, whereas when the virulence is still greater, death from pneumococemia results. These and other facts suggest strongly the possibility that previous to an attack of rheumatism various types of the streptococcus group, especially hemolytic streptococci, acquire in the tissues of the infected individual the features which give the simultaneous affinity for joints, endocardium, pericardium, and myocardium.

"The experiments on mutation show that when these and other streptococci are grown in symbiosis with other bacteria, and under a low oxygen pressure, they may acquire new features and that sometimes they undergo marked changes on passage through animals. The places in the human body where such conditions prevail and where special features are likely to be acquired are parts of infection, such as in the tonsils, various sinuses, the appendix, and about the gums and teeth. That this actually occurs in the tonsils in rheumatism seems quite clear; the mild character of the tonsillitis at the time of the attack and the late appearance of rheumatism in some cases of acute follicular (streptococcal) tonsillitis, accord with this idea. The importance of focal infections as a point of entrance of bacteria in general is quite well recognized, but the idea that the focus serves in addition as a *place where bacteria can acquire new properties* (italics my own), is not generally recognized and needs to be emphasized."

While these conclusions have not been generally accepted, after all, they have suggested a fascinating way of approach in the study of focal infections in general and of the arthritides in particular. McMeans¹² experimented upon ten rabbits under control with a single strain of streptococcus—*Streptococcus pyogenes* (Holman)—of submaxillary gland of the human. His aim was to preserve a possible elective affinity for the submaxillary gland, and his technique followed closely that of Rosenow. The lesions produced in the rabbits were almost entirely limited to the joints instead of the submaxillary glands. The quality of this organism of attacking the joints was not lost after a period of three months of artificial cultivation. McMeans¹³ concludes that, "it would be difficult to ascribe to an organism a particular affinity for a given tissue unless the reaction is read in terms of intensity over and above that noted in other tissues." He further came to the same conclusions with respect to mutation and elective affinity of certain microorganisms in his experiments on artificial acute inflammations of the appendix.

Henrici,¹⁴ in an article on the "Specificity of Streptococci," in which he reported his results from inoculating fifty-three strains of streptococci from various sources into two hundred and twenty-five rabbits, with the purpose of comparing the virulence and elective affinities with the powers of hemolysis and carbohydrate fermentation, concludes: "We are not justified from evidence obtained by rabbit inoculation experiments in recognizing any particular class of streptococci as specific for rheumatic fever, since the various rheumatic lesions, arthritis, myocarditis, endocarditis, pericarditis, and myositis, may be produced by some strains in each of the varieties and are produced in equal proportion by both hemolytic and non-hemolytic streptococci."

In this whole controversy one must not lose sight of several facts. *First*, while many attempts have been made and reported, it seems no one has yet found a microorganism with which he can at will reproduce the clinical picture of acute rheumatic fever. *Second*, while there seems to be a definite relation between foci of infection and the acute, sub-acute, and chronic varieties of joint lesions, no one has yet

been able to explain why the same microörganism in one individual will apparently produce an acute rheumatic fever with temporary changes in joint and muscle, but destructive changes in endocardium; in another, extensive permanent change of the soft tissues of the joint only, and in still another profound destruction of the cartilages and of the bony structures of the joint, while the endocardium escapes.

It is to be hoped that the fascination which this field of investigation affords will continue to lure able investigators on until the problem of the infectious origin of the arthritides is permanently solved.

Even though the specific microörganism of chronic infectious arthritis is at present not known, there are certain reasons why one is inclined to conclude that there is a definite causal relation between a focus of infection and an existing inflammatory process in joint structure. What are some of the evidences which permit of such conclusions? They are largely based upon clinical observations which have been noted in acute rheumatic fever, and in subacute and chronic multiple arthritis for many years, or since these conditions were first differentiated.

First, there is the coexistence of the lesions. An acute infection of the throat occurs, and coincidentally or following there is joint affection. This occurs so frequently that their relation is acknowledged generally. *Second*, an acute exacerbation of the focal infection is followed at once by an increase in severity of the joint symptoms. This has been noted also when anything is done to aggravate the focal process, such as expression of secretion from the tonsils, especially if roughly done, or local application to diseased tonsils. The extraction of an infected tooth, or the immediate effect of the drainage of infected sinuses, will frequently result in a sudden flare-up of the heretofore subsiding joint symptoms. And *third*, the removal or overcoming of a focus of infection in a reasonable time may be followed by recovery from the joint affection. From these facts there is abundant evidence to conclude that *the common and exciting cause of the subacute and chronic arthritides is a focal infection.*

The location and modes of entrance of the infection is an important factor in the etiology of joint diseases, since upon an understanding of these factors a rational treatment may be established. In certain conditions the focus of infection, such as of the teeth and tonsils, can be easily determined, but in others, such as certain of the sinuses in the upper respiratory tract or certain lesions in the gastrointestinal tract and in the genitourinary tract, it may be difficult to determine.

In searching for foci of infection one should always be able to demonstrate that a lesion actually exists, and next that there is reasonable evidence that it is the primary cause of the lesion of the joints in question. The first of these requirements should not be difficult to one who is accustomed to make careful clinical studies of his cases and who can surround himself with a group of reliable clinicians, laboratory workers and specialists. The second is largely a matter of exclusion, in which sound logic controlled by good common sense should prevail. The prevailing tendency to attribute indefinite symptoms and obscure diseases to "focal infection" is liable to work hardship and harm to the unsuspecting patient. If the fact is once lost sight of that a so-called focus of infection must be a veritable pathological lesion before it can be considered a part of the chain of conditions leading to an infected joint, the treatment of the condition will be disastrous. The possible relation of "sub-infection," as defined by Adami,¹⁰ to the arthritides may lead one to incriminate most any organ when he is on the search for foci of infection. The supposed relation of disturbance of the gastrointestinal tract to joint diseases is a good example. On account of a ptosis of the stomach and colon, and on account of fecal stasis, it is assumed that microorganisms (existing in unusual number) gain entrance to the blood-stream through a practically intact mucous membrane. These microorganisms, though usually avirulent, break down the defenses of the tissues and become virulent. Disease processes accordingly result and among these are certain well defined joint lesions. Such a chain of reasoning is fascinating, but should not be accepted until an actual lesion is found in the gastrointestinal tract, or an invading

organism is found, red-handed, as it were, breaking through the natural defenses.

In discussing the essential causes of polyarthritis one may well consider the relation of disturbances of body metabolism to the disease process. The border line between an infectious arthritis and an arthritis due to metabolic change is not always definite. Both etiological factors may be at play in the same joint at the same time. Ralph Pemberton, in a number of comprehensive papers since his first report in 1914, has shown from many standpoints the relation of metabolic disturbances to the different forms of joint diseases.¹⁵ In a second contribution,¹⁶ Pemberton concludes that from a clinical standpoint, at least, rheumatoid arthritis seems to belong to the category with diabetes and gout. This had long been accepted by clinicians, but it remained to be demonstrated. He claims that the fault is both with carbohydrate and proteid metabolism, and possibly also with the fats. He speaks of an associated infection as being intercurrent, or possibly causative, and says in the large group of cases in which a causal source of infection cannot be found or removed, the dietetic treatment is particularly indicated. This will be discussed more fully under treatment. In a subsequent paper Pemberton¹⁷ calls attention to the prevailing lowered sugar tolerance found in chronic infections, especially in cases with diseased tonsils and infected joints. The lowered tolerance is found in a large proportion of the cases and is "roughly proportional" to the activity of the arthritis, and also that in some cases this disturbance of carbohydrate metabolism may be due to the focal infection rather than to the disease under consideration. These observations have been confirmed to a degree by the writer in a number of cases and have served to emphasize again the close relationship between nutrition and infection. But the writer is of the opinion that the relation of disturbed metabolism to joint affection is the same as that of traumatism, which has already been discussed. It prepares the field for the invading and determining microörganism, but of itself is not sufficient, except as in gout, which is generally considered a non-infectious lesion.

PATHOLOGY.

Before discussing the morbid process which takes place in inflammation of a joint, it might be well to consider in a sort of a review the structures which go to make up a joint. Usually the character of joint disease is determined by the particular tissue affected and the degree or extent to which the lesion has progressed. Not all tissues are affected alike.

A joint consists primarily of the coaptation of two or more bones, which move to a greater or less degree one upon the other. Between the bones lies a sac called the synovial sac, which is lined with a layer of endothelial cells. The sac frequently extends beyond the coaptating bone surfaces, forming a fringe. It contains fluid which is much like a simple serous fluid except that it contains mucin and albumin, giving it a slimy consistency. The bones forming the joint are in turn held together by ligaments which pass from the lateral surface of one to the lateral surface of the other, or may pass from the end of one bone to the end of an adjacent bone, as in the crucial ligaments of the knee joint. The synovial sac may extend between the interstices of the ligaments, especially when under tension of excessive fluid. Between the synovial sac and the bone proper lies the articular cartilage. External to the ligaments are the muscles and tendons with their sheaths, and external to these are commonly muscles, such as the deltoid muscle over the shoulder joint. Occasionally between the overlying muscle and the tendon sheaths is a bursal sac which has the same structure as a synovial sac and contains a like fluid. There is an adequate blood and nerve supply, as well as a lymphatic system. Over all this is the skin, with the subcutaneous fat and the areolar tissue.

When an inflammation of the joint (an arthritis) occurs, whether precipitated by traumatism or due primarily to an infecting microorganism from within or without, the beginning is usually in the synovial sac of the joint, or in a bursa, or in the tendon sheaths, or wherever endothelial cells lie. A hyperemia occurs and there is an increase of the serous contents, producing tension and swelling. The character and

extent of this depends largely upon the form and type of the invading microorganism, and possibly upon the age of the individual and the degree of body resistance and the kind of joint affected.

With reference to age, Silver¹⁸ has suggested that the age of the joint influences the character of the pathological change; the hypertrophic type occurring in joints physiologically old; in favor of this is its preference for the second half of life, its frequent association with general arteriosclerosis, and the occurrence of the sclerotic changes in the joint vessels. With reference to body resistance, McCrae¹⁹ suggests that in cases of arthritis of the more acute type of onset the system is showing a more marked response and a more active resistance to the infective agent and its toxins than in those with a more gradual onset in which we may assume the body defenses are unable to rise to the emergency. This may explain, to a degree at least, why the same organism from apparently the same focus of infection may in one (the child, or young adult) produce acute rheumatic fever, in another (the young adult or mature individual) produce a subacute or chronic multiple arthritis, and in still another (the one in the second half of life, and the aged) a permanent hypertrophic or atrophic change, as in arthritis deformans.

As soon as the synovial sac undergoes inflammatory change the surrounding soft tissues begin to undergo the same change. There results, with the rapid increase of the serous contents of the synovial sacs and bursal and tendon sheaths, an infiltration of the surrounding soft tissues, a definite swelling and change of contour of the joint. This constitutes a *serous arthritis*, is of an acute or subacute nature usually, and may resolve without leaving any trace of change in structure or function (acute rheumatic fever).

The process may be more severe and the synovial fluid become turbid with added deposits of fibrinous material. This constitutes a *serofibrinous arthritis*, and may result in organization and permanent joint changes such as are found in subacute and chronic multiple or polyarthritis. The inflammatory process, as it extends to the surrounding soft

tissues of the joint, may produce a more or less permanent deformity (infectious arthritis).

If pyogenic microorganisms prevail a *suppurative arthritis* occurs, and with this there may be a destruction of synovial sacs and cartilages, resulting in a true osteoarthritis (arthritis deformans). The pathological change in a chronic arthritis is almost entirely a local process. Other organs and tissues are not involved primarily but may be secondarily on account of functional disturbances resulting from the extreme general physical debility which may accompany a chronic arthritis. These may be called terminal changes.

However desirable it may be to make a distinct clinical differentiation between an infectious arthritis, and the arthritis due to metabolic disturbances (gout), one must recognize that under certain circumstances the infectious and metabolic processes go hand in hand. Thus in a chronic infectious arthritis there may be deposits due to the long continued local inflammatory process interfering with the nutrition of the joint, and in a gouty joint there may be occasional inflammatory reactions due to the ever-present microorganisms of a subinfection as suggested by Adami.

SYMPTOMATOLOGY.

The symptoms of acute, subacute, or chronic arthritis are characterized by localized pain, redness, swelling, and disturbance of function of the joint. There may be a slight systemic reaction, as chilliness and a moderate increase of temperature, but frequently this is so mild as to go unrecognized; occasionally it is high and of a hectic type. There is a distinct sense of local heat to the touch. There may be only one joint affected but there are usually a group of joints, as of the wrist and the fingers of the same hand. Both hands may be affected, and the condition thus localized throughout the entire course. The lesion is usually symmetrical. In some cases there seems to be a predilection for the large joints, while in others it is the small joints. The periarticular tissues are involved, and the signs of a mild effusion may appear. Whatever constitutional disturbances there are, usually subside in a few days, or at least they do not run a long course. The local conditions

remain for a much longer time. The redness of the joint disappears but some degree of swelling and stiffness remains. At a subsequent attack the joints formerly involved are more likely to relight first. The subsequent attacks may not be so severe, but they leave the joints more disabled. These recurrences occur from time to time until the joint is more or less fixed or ankylosed. There may be a slight leucocytosis during the first attack but at subsequent attacks the blood is usually normal.

If a focus of infection is responsible for the disease, any disturbance of the focus may precipitate an exacerbation in the joint. This is strikingly noticeable in case of chronically infected tonsils when vigorous local treatment of the tonsils is persisted in.

During the height of an attack, especially if it is the first attack, fluid may be aspirated from the joint. This is usually sterile, insofar as ordinary cultural methods are concerned. At each subsequent attack the evidence of fluid is less marked. The movement of the joint becomes gradually more restricted and finally complete ankylosis may occur. The shape and size of the joints are markedly changed. This is particularly emphasized, when, on account of loss of joint function, the muscles and tendons become atrophied.

The pain is at first quite severe, almost as severe as in acute rheumatic fever. It is not particularly increased at night. Later as the joint becomes more fixed, the pain is less, and finally, in complete ankylosis, there can occur an acute relighting of the joint with redness and swelling but with little, if any, associated pain. The joints, especially those of the fingers, take a fusiform shape. The temporomaxillary and the joints of the spine are frequently involved, in fact, there is no joint, or set of joints, which are immune to the infection. Depending upon the direction and character of the extension of the inflammation, and also upon the distribution, the process has been distinguished by certain terms, such as atrophic arthritis, hypertrophic and osteo arthritis, and spondylitis. There are also certain forms which have been named after the clinicians who first called attention to the peculiar lesion, such as Heberdon's nodes, the Von Bechterew type of spondylitis, the Strumpell-Marie

type, and Still's disease. These are nothing more nor less than rather advanced types of infectious arthritis, and probably do not deserve any special classification. However, they will be discussed later, when considering so-called arthritis deformans.

There is seldom hyperpyrexia, and a complicating endocarditis is very rare. Very few, if any, complications arise. If the patient is beyond middle life and becomes greatly restricted in the usual physical activities, and does not follow an imposed diet, there is a general tendency to obesity. The accumulation of weight is, in a way, very unfortunate, especially if the knees are largely involved. The additional weight thrown upon the knees is likely to tend toward greater injury to the joint when attempting to walk, with more pain, which, in turn, limits the physical activities, and thus a vicious circle is established.

Usually a slight secondary anemia is present. There are no characteristic blood findings. The urine is normal. Studies made by Pemberton and others fail to show any characteristic kidney disturbance or digestive disturbance.

Arthritis Deformans. It was stated at the outset of this article that arthritis deformans will be considered as having the same etiology as that of multiple secondary, or so-called polyarthritis of an infectious nature, and hence will be discussed under the same heading. Heretofore it has been the custom to consider arthritis deformans as a distinct entity, and it has usually been classified with such nutritional diseases or diseases of metabolism, as diabetes mellitus and insipidus, gout, and rachitis. It is the opinion of the writer, based upon extensive clinical observations and upon the published reports of laboratory investigators, that this condition is due to an infection, and represents only the advanced or highly chronic stages of an ordinary polyarthritis, the etiology and pathology of which have already been discussed. It will only be necessary, therefore, to call attention to the peculiar symptomatology which characterizes some of the stages of a chronic polyarthritis.

Chronicity in this condition is not always measured or estimated by the length of time the joint has been involved, for a polyarthritis may, early in its course, give the evidence

of a deformity of the part affected which is likely to characterize the course of the disease. This is due to the distribution of the infection, as to whether it is confined to the synovial sac or whether it spreads to the cartilages, or to the tendon sheaths and surrounding tissues, or to the bony structure of the joint.

The deformity of the hands, therefore, on account of anatomical conditions, is peculiarly striking. There is an early ulnar deflection, which may become quite marked. The distal phalanges are deviated to one or the other side, or may be flexed at an obtuse angle, and the metacarpal bones become concave on the dorsal side, the carpal bones become prominent on the dorsal surface. This produces the peculiar "silver fork deformity." The joints gradually become fixed. Some of the fingers become fusiform in shape. This process is usually more marked in the right hand. The elbows and shoulders are next involved. The same peculiar deformity has a tendency to occur in the feet and ankles, but on account of the natural splint which the shoe affords, it is not so great as in the hands. This is a fact which is often strangely overlooked in these cases. The orthopedist has called our attention to the fact that early support, in the nature of a splint, to the phalanges or the entire hand, may prevent the deformity, as it is prevented in the foot. In the lower extremity the process is most marked in the ankles and the knees, in fact, more marked correspondingly than in the wrist and elbows. This is no doubt due to the fact that the patient insists upon bearing the weight of his body on these joints for a longer time than he should. This again points to rest, especially in bed, as a necessary factor in treatment. As the joints become involved and the tendons fixed in their sheaths, atrophy of the muscles in relation to the shafts of the bones occur. The joints become thus relatively large, but they also enlarge on account of the inflammatory proliferative process taking place. Hence the atrophic and hypertrophic forms. The patient sooner or later becomes helpless, bed fast, with uncomfortable deformities. In some this whole process may develop in the course of two or three months and the patient become an absolute, permanent cripple. This rapid process is more likely to

occur in the young. In the older individual the progress of the disease is relatively slow. Frequently there is a peculiar and distressing crepitation in the joints, especially in the knees and wrists. Depending upon numerous circumstances, but probably most frequently upon the renewed invasion of a focus of infection, there may be an acute exacerbation in the joints, when they become red, inflamed and painful as at the outset of the disease. As the disease develops and joint after joint becomes fixed, the patient may become helpless to the extent of being unable to separate the jaws. The vertebræ become fixed and the patient's condition is truly pathetic.

Villous Arthritis. This process, which Goldthwaite has described, can scarcely be confused with a chronic infectious arthritis of the type of arthritis deformans. From the standpoint of etiology they differ greatly. However, the static and infectious elements may be contributory causes in both conditions. If the infectious element predominates it may be difficult to determine, in a single joint involvement, to which group the condition rightly belongs. But it should not be confusing when one remembers that villous arthritis is most frequently confined to the knees and that the other joints may be singularly free from disease. The distribution and the striking physical condition characterize quite definitely this form of arthritis.

DIAGNOSIS.

It is necessary to note at once that infectious arthritis, even though it may have acute manifestations early in the course, is a chronic disease. If a careful history is taken and a thorough physical examination is made, usually the evidence of previous joint disease will be found. In the very early acute stage, however, it is often difficult, in fact at times impossible, to differentiate from acute rheumatic fever. Fortunately time usually comes to one's assistance and this, as the differences in symptoms become manifest, decides the diagnosis. The following table may be helpful in differentiating:

CHRONIC ARTHRITIS FROM ACUTE RHEUMATIC FEVER.

	<i>Chronic Polyarthritis.</i>	<i>Acute Rheumatic Fever.</i>
<i>Age</i>	Middle life or later.	Childhood to middle life.
<i>Onset</i>	Gradual.	Rapid from joint to joint.
<i>Distribution</i>	Symmetrical.	Scattered, irregular.
<i>Deformity</i>	Always more or less permanent and characteristic.	Rarely if ever permanent.
<i>Pain</i>	Mild to severe.	Severe to excruciating.
<i>Swelling and redness</i>	Moderate.	Marked.
<i>Temperature</i>	None or slight, only occasionally high.	High, frequently hectic.
<i>Pulse</i>	Slight increase.	Rapid.
<i>Sweats</i>	None.	Marked.
<i>Endocarditis</i>	Rare.	Frequent.
<i>Skin</i>	Purpura-rare. Erythema absent.	Purpura-frequent. Erythema present.
<i>Blood</i>	Slight leucocytosis.	Marked leucocytosis.
<i>Effects of Salicylates</i>	Unsatisfactory.	Usually prompt and satisfactory.

It will be seen from this table that nearly all the symptoms of one condition are found in the other, the difference being only in the degree of severity.

If acute rheumatic fever can be excluded with a reasonable certainty, it still remains to differentiate the condition from certain other diseases of the joints. Among these are certain septic joint conditions, also gonorrheal arthritis, syphilitic arthritis, tuberculous arthritis, and acute and chronic gout. An acute bursitis, or a tenosynovitis, may be mistaken for a mono- or a polyarthritis, and finally such conditions as flat feet, sacroiliac strain, and the congenital deformities of joints must be excluded. These conditions are discussed under their separate headings, and while theoretically chronic infectious arthritis should be readily differentiated from them, the report of a concrete case will serve to demonstrate how difficult the diagnosis may be.

Miss McM., aet. 18, was admitted to the hospital complaining of pain in the joints which had begun three months ago. It followed an attack of tonsillitis. She said she had just recovered from an "attack of pneumonia" which came on while she was in bed suffering from her swollen and painful joints. The hands and feet had been swollen and at present the right knee was extremely painful and swollen.

In the course of the physical examination it was found that the patient was about four months pregnant. The right knee was red, acutely swollen, and was very tender. No other joints were involved. A purulent vaginal discharge was present. The temperature was hectic, going from 98° to 102° F. There were profuse sweats at times. The heart was normal. The leucocytes were 18,000, the Wassermann was negative, and a blood culture was sterile.

A smear from the vaginal discharge was negative for gonococci. However, neither syphilis nor gonorrhea were entirely excluded as there was an offensive ozena, and a perforation of the nasal septum and it was found there had been a previous pregnancy. Salicylates were given in large doses as only in this way could the pain be controlled. After a month the patient had a miscarriage and in six weeks more with continued salicylate medication the fever and pain had disappeared. The leucocytes were 11,000. In a month more the patient was ready to be discharged, but there remained a considerable enlargement of the right knee joint. At no time was there pain in any other joint.

Summary. A patient with apparently a monoarticular affection, high temperature, no cardiac complication, questionable vaginal discharge, but no gonococci after repeated examinations, a perforated nasal septum, with a negative Wassermann, and an apparent cure with salicylates, leaving an enlarged and stiffened knee joint. While the preponderance of evidence seems to be in favor of this being of gonorrheal origin, a definite diagnosis could not be made.

This discussion cannot be properly closed without calling attention to the remarkable frequency of so-called sacroiliac strain, "sacralization" of certain lumbar vertebræ, hamstring tension, and "faulty posture," which exists among a large group of patients seeking relief from joint disease. These conditions are often mistaken for rheumatism, or for an infective polyarthritis. It is the experience of the writer that many of these patients do have definite foci of infection, but they are not necessarily the cause of the pain. They should be taken care of from this standpoint, of course, but no results can be expected unless the orthopedic side of the case, which is practically the only side, receives careful attention.

TREATMENT.

A disease which is of such uncertain origin and which has such a tendency to run a protracted course, sometimes leading to chronic invalidism permanently crippling the

patient, is one that should be prevented if possible. Though our knowledge of the condition is far from complete, the relation of certain factors to the disease have been well established and form the foundation for rather definite preventive treatment.

Prophylaxis. The lowering of the powers of resistance and the exposure to certain general infections are the two factors which seem to contribute largely to the incidence of joint diseases. Individuals should avoid the dangers which frequently arise from an unbalanced diet. They should not lend themselves to dietetic experiments, such as are usually recommended when an indefinite pain in the joints is experienced. The obscure pains in joints will frequently be interpreted as of rheumatic origin, and lead to the establishment of a diet which will tend to make the patient all the more susceptible. Excessive physical fatigue and exposure to cold and wet should be avoided. Mental and nervous strains are equally injurious. Next to a well balanced diet of sufficiently nourishing food is the necessity for systematic rest and sleep. The habit of being in the open air as much as possible and of having the living and sleeping rooms well ventilated is of great importance. The ventilation of school rooms and of business offices should receive scientific attention. Adequate clothing should be worn. Many attacks of joint infections are precipitated by having cold and wet feet.

It is advisable also to have at stated times a physical examination made by some physician who is in sympathy with prophylactic medicine, and who appreciates the value of preserving health as much as of curing disease. Such an examination may lead to the discovery of errors in diet and errors in the ordinary methods and habits of life. It may also lead to the early discovery of foci of infection which can be properly dealt with. These physical examinations are particularly helpful in persons beyond middle life. There is no doubt that life could be prolonged and much suffering avoided if physicians would attempt to impress upon their patients and the families with whom they come in contact the value of thorough physical examinations at stated intervals. Everyone must acknowledge the definite advantage which occasionally comes to an individual because he has

undergone the routine examination required by a life insurance company or by a "lodge."

General Management. Whether the initial attack is acute and extensive, or early, mild, and localized, *rest of the part affected* is of greatest importance. It is of great importance also that the early manifestations of the disease are carefully observed so that a diagnosis can be definitely established, and the proper treatment instituted. The unintelligent, aimless treatment of joint disease is a sad reproach upon our profession, and no doubt is responsible for the origin of the many healing cults with peculiar names which are being foisted upon an unsuspecting public. Orthopedists are particularly impressed with the shortcoming of the average practitioner when he comes in contact with joint diseases. He is likely to overlook the very early manifestations and to consider all joint pain and disturbance as of a rheumatic nature until confusing complications arise.

It is needless to say that the general management of a subacute or chronic case of polyarthritis should include the elimination of the supposed etiological factors which may be responsible for the infection. Besides the elimination of foci of infection it should also include the reestablishment of the normal body resistance, and the restoration of joint function. These three aims may be pursued at one and the same time, but there is a natural order in which they should be undertaken. It may be of very little avail to try to build up a patient if a slow infection is continually feeding into the system. Also it may do little good—in fact it may do more harm than good—if a joint is manipulated and exercised before the foci are completely eliminated and the general health is on the mend.

Whatever cause is operating, should therefore, if it is possible, first be removed. Much has been said and written in defense of the relation of focal infection to diseases of the joints as well as to many other diseases. Attention has already been called to the fact that this is still, insofar as the arthritides are concerned, largely a matter of theory, and has little more in its favor than *post hoc propter hoc*. However, this should not deter one from making a definite and

systematic search for such foci and from attempting to overcome them.

Pyorrhea should be treated as such because it is present and may impair the general health to the extent of making a joint more vulnerable to disease process. It may or it may not have a direct causative relation to the joint or joints immediately affected, but it should be corrected, if for the purpose of saving the teeth alone. The same may be said of dental caries, and of apical abscesses. This is a safe attitude to take in the disposition of all foci of infection where the treatment of joint diseases is under consideration. Of these foci, apparently, from the writer's experience and from the experience of others who have reported cases, the most frequent are the tonsils, the teeth, the sinuses leading into the nasal channel, the middle ear, the genitourinary tract, the gastrointestinal tract, and the respiratory system in general.

In the genitourinary tract in the male the prostate gland and the seminal vesicles are frequently the seat of infection, and in the female the endometrium and the tubes are most likely to carry infection. In both sexes any part of the entire urinary tract may be chronically infected and serve as a focus. In the gastrointestinal tract the colon and particularly the appendix has been held under suspicion by many clinicians and investigators. Also the biliary tract and the stomach and duodenum are supposed to harbor germs which may feed into the blood stream. The upper respiratory tract has already been mentioned. The bronchial tree and the parenchyma of the lungs may, under certain conditions, be the seat of focal infection. In the treatment of the arthritides, therefore, where it is attempted to eliminate the supposed foci of infection the undertaking must be thorough and complete. Halfway measures will not suffice, either from the standpoint of curing the disease or of establishing the fact that the disease was due to any one particular focus.

The writer has in a number of cases seen good results, apparently, from removing foci of infection, but he has also seen undoubted failures. In some of these cases it was found that the investigation had not been thorough, and one or another point had been overlooked. In other cases it was

found that the eradication of the focus, for some reason or other, was not complete. For example, a pair of tonsils was removed, or thought to have been removed, when later a tonsillar "stump" was found to have been left. When this was removed, the results were satisfactory. In fact, it seems that the lesion in the joints is frequently decidedly aggravated after an incomplete tonsillectomy. Until this was fully appreciated, many patients were compelled to have a subsequent complete enucleation of the tonsils. The same may be said of the sinuses and in fact of any forms of infection, unless the removal is complete, harm may come from the procedure.

The failures which occur even after the work has been done thoroughly may be due to various causes. Among these may be the fact that the state of nutrition is so low, as the result of the disease, or from other causes, that there can be no repair; or again, that the lesion is so far advanced that under the most favorable circumstances there can be no approach towards the normal. It may also be possible that the lesion in one or other joint may in itself remain active and supply sufficient infective material to light up the process from time to time in other joints which had not heretofore been involved. If this opinion has any foundation, it can readily be seen that the problem of focal infection in relation to the arthritides is complex and difficult from every standpoint.

The question occasionally arises as to whether a focus of infection should be operated upon when the disease is in the active stage, or where there is an acute exacerbation. Unless there is some other condition which would contraindicate operative procedure, there should be no reason for delay, and operation should be done as soon as possible. The question of safety on account of the acuteness of the joint condition, however, is not nearly so important as is that of the acuteness of the focus of infection itself. To operate on chronically diseased and hypertrophied tonsils for example, when they are in a state of acute exacerbation, for the purpose of curing an acutely inflamed joint, may make a very dangerous operation when, by a little waiting, a comparatively safe operation will do as much or even more

to bring about the desired results. The whole matter of focal infection in relation to the arthritides resolves itself into the plain fact that it must be based upon sound clinical and surgical judgment, with additional good sense.

The care of the general health of the patient suffering from an infectious arthritis is of considerable importance. This has already been discussed with reference to the etiology of the disease and the preventive care. It has been pointed out that these patients are usually in a state of subnutrition, though occasionally the disease seems to be the result of overeating and under exercise. Of the latter the obese patient is a good example.

The patient should have a well balanced, nutritious diet. The normal or standard weight should be maintained. Pemberton has called attention to the advantage of under feeding and especially to the benefits arising from keeping the carbohydrates approximately lower than the other elements of the diet. The tendency in these patients is, however, already towards subnutrition. This may be accounted for in several ways. The patient usually has a preconceived idea that he needs "an anti-rheumatic" diet, or he is told by his friends that such a diet is necessary; he accordingly deprives himself of one article of food after the other until he is in a state of subnutrition. Again, there is not always the studied care taken by the physician to differentiate between acute rheumatic fever, chronic polyarthritis, and gout. All are included under the general term "rheumatism," and a so-called "anti-rheumatic" diet is prescribed. This usually consists of a diet with very little meat and the exclusion of sour foods, and the avoidance of alcoholic stimulants. The carbohydrates and fats are allowed, apparently without reservation. From our present knowledge of the arthritides such a diet must be considered largely empirical. There is no doubt that the obese, over-fed patient will do well with a diet of low caloric value. This is often the case in patients who consult the physician in the early stages of the disease. On the other hand, those who consult the physician later in the disease, when their nutrition is already greatly impaired, should have a well balanced diet of high caloric value. In short, there is as yet no rational basis for a specific diet for patients

suffering from either an acute or a chronic arthritis. The arthritis patient is usually more or less limited in his ability to live in the open air and to have the proper amount of physical exercise. The diet from this standpoint again should vary in proportion to the extent of the disability. The aim of all dietetic measures should be to obtain the highest state of nutrition and health possible under the existing disability.

Restoration of the function of the joints is to be considered as well as the elimination of foci of infection and the restoration or maintenance of bodily health.

The treatment for the acute stage of the infection has already been established in the manner described, that is, rest has been instituted, local applications, such as cloths soaked in a saturated solution of sulphate of magnesium, or lead water and laudanum, or an ice-bag, or a hot-water bag, or alternate heat and cold, have been applied. Probably fixation of the joint has been found necessary, either by an ordinary felt, wooden, or wire splint, or in a more thorough way by the application of a plaster bandage. With these procedures the pain, redness, and most if not all of the swelling may disappear, but the function of the joint may remain impaired as the result of more or less permanent swelling and stiffness, or by adhesion and deposits. This loss of function may be restored by using the joint in doing the ordinary duties of life, taking them up gradually, or certain specific movements can be prescribed. If these are persistently carried out, in most cases the results will be satisfactory. This is especially so if the foci of infection have been completely eradicated. If they have not been eradicated, the joints will usually become more inflamed and their use must be temporarily discontinued.

If there is no inflammatory reaction with a definite attempt of function, mechanical means may be safely instituted. These include massage and Swedish movements, and the use of certain appliances such as weights and pulleys as ordinarily found in a gymnasium equipment. These treatments should be begun very gently and increased as the special condition of the joint will permit.

In the acute joint the mechanical treatment may not be applicable; in the subacute it should be very mild at first,

and in the chronic it may be heavy, even to producing mild inflammatory reactions. No hard and fast rules can be set, but it must always be kept in mind that any treatment which is so severe as to produce a local reaction lasting for over twenty-four hours is likely to do more harm than good. The patients should be instructed to treat themselves whenever it is possible. Such treatments must necessarily be carried on for a long time—for months and years sometimes—and make it impractical from the standpoint of compelling the patient always to have some one at hand to exercise the joints, or impossible for some on account of the expense which such a prolonged course entails.

Sometimes the joint is partly or completely ankylosed and one would think that no such mechanical treatments would be of any avail. It is remarkable, however, what can be accomplished if a patient will coöperate and persist in the treatment. If the ankylosis is such that no results can be expected from passive movements, or if passive movements have failed, the advisability of giving the patient an anesthetic and breaking the adhesions should be considered. It is a question which taxes one's judgment to determine whether a joint should be thus severely dealt with or whether passive movements, massage, and exercise, should be continued longer. It must always be remembered that after the forcible breaking up of the adhesions of a joint, it must for the time receive the same care as an acute joint, and must be eventually restored by employing first gentle and later more or less severe passive movements. It requires a great deal of judgment to decide in a particular case whether further passive movement should be continued or whether more active treatment should be undertaken.

These patients constitute the class of cases which are frequently benefited by a sojourn to certain mineral springs or resorts which are supposed to have a specific effect. There is no question that some are greatly benefited by hydrotherapy, massage, and the régime which is usually instituted. Prolonged hot baths may, however, be debilitating and may do more harm than good. The change in diet which is usually insisted upon, whether rational or otherwise, is often quite different from the patient's accustomed diet, and may

therefore have a good effect in those cases where gastrointestinal disturbances are an etiological factor. Drinking an abundance of water, which is usually required at these resorts, is also helpful. Extremes in diet should, however, be avoided.

Certain other special treatments in these cases are of considerable value. Among these are *superheated air*. Some twenty or more years ago it was advocated to place the ankylosed joint in an apparatus made of layers of sheet tin, asbestos, and felt. Heat from an ordinary gas jet or an alcohol lamp was applied beneath the apparatus and the temperature of the compartment was raised at times to 200° or 250° F., with no danger to the part treated and with considerable relief from pain. After the treatment by superheated air the part is massaged, and attempts are made to overcome whatever ankylosis might be present. This is a form of treatment which has been supplanted, largely because of the ease of the application by *heat from electric light*. This heat, besides being more readily applied, is supposed to penetrate the tissues more easily than that from superheated air. An electric light bath including the whole body may be given where many joints are involved. What is concluded to be the best form of heat, however, is that which comes from exposing the joint or lesion to the *direct rays of the sun*. This has been recognized for some time in the treatment of tuberculous lesions of the bones and joints. It is systematically employed in certain health resorts, especially in the Alps, where the benefit of high altitude and reflected light from the snow may be secured. The results of direct or reflected sunlight in polyarthritis are equally as good as in tuberculous arthritis. The treatment can be carried out whenever the sun shines. The local effect is quite definite, and unless care is exercised to avoid exposing too much of the body surface at a single seance, harm may come from the treatment. The part or parts should be exposed for certain hours regularly each day. The effect of the direct sun rays in this condition, as well as in other diseased conditions, is not sufficiently appreciated. The *Roentgen rays*, as well as radium emanations, have been used in chronically inflamed and ankylosed joints, but the skill required for such

application, the tediousness and expense of the course, make them a more or less impractical procedure.

The plan of producing a local and *temporary hyperemia* of the joint according to the method of Bier,²⁰ of Bonn, has been followed with excellent results, according to the reports of some clinicians; in the hands of others, among whom is the writer, the method was difficult of application and the results not always satisfactory. In fact, in all of these applications a large factor, which is most likely to be the deciding one, is the patient and intelligent coöperation possessed and displayed by the patient and the physician.

The treatment of polyarthritis of the subacute and chronic types by means of *vaccines*, specific or polyvalent, and mixed, has from time to time been attempted. From the very fact that no specific microörganism has yet been found in the joints affected, and that the etiological relation of foci of infection to affected joints is still far from being proven, there can be no other conclusion than that such treatment lacks a scientific basis. This is the reason, no doubt, why the reports of such treatment as carried out by different investigators and clinicians do not altogether harmonize. Some report favorable results, while others report unsatisfactory and even harmful results. The writer has attempted in a number of cases, autogenous vaccines obtained from supposed foci of infection, such as the tonsils, teeth, and alimentary tract in general, but thus far has not been able to report a single conclusive satisfactory result. More than this in some cases the results apparently were disastrous. The use of polyvalent vaccines in these cases should be condemned.

Since the publication by Miller and Lusk,²¹ the effect of *protein shock reactions* on the arthritides has been observed by many investigators and clinicians. The protein shock therapy is instituted by injecting a foreign protein into the vein. The protein usually employed is the typhoid vaccine. Miller and Lusk at first used a four per cent. proteose solution but later found the ordinary typhoid vaccine as satisfactory. This has also been used in cases of acute rheumatic fever. The reaction is often quite profound, resulting in a severe chill, followed by a high fever and profuse sweat.

The patient experiences relief from the pains almost at once. This at first, however, is only temporary. In a few days or in a week another injection may be given, and after a time the relief becomes more permanent. This therapy has also been tried by the writer and in certain less advanced cases the results have been fairly satisfactory, but in the advanced, markedly ankylosed cases, the results were, to say the least, discouraging. The reactions are sometimes so severe and unpleasant as to lead to considerable objection on the part of the patient. The danger of such therapy as compared with vaccine therapy seems to be very small. The success of the treatment seems to depend largely upon the stage (early) at which it is instituted and the persistence with which it is followed.

Medical Treatment. The indications for medication in chronic arthritis are for the relief of pain and for the improvement of the general health. There is no specific medication. For the relief of pain the salicylates in their various forms may be given, though with varied results. Aspirin, guaiacol carbonate, the iodides, antipyrin, and pyramidin, may be found useful. Opium and its alkaloids, especially codein, may be necessary if the coal tar preparations are not satisfactory. However, one should always be careful in prescribing opiates in chronic conditions.

It has been the experience of a number of observers that the administration of ether will overcome the pain to a large extent for a limited period. The writer has frequently noticed this following a tonsillectomy in the course of the treatment of a polyarthritis. The patient usually experiences remarkable relief lasting for several days, when the pain returns and sometimes with greater severity for a time. As in acute rheumatic fever, cinchophen or neocinchophen has been recommended where the salicylates have been unsuccessful.

The medication given for the improvement of the general health are usually directed towards a coëxisting anemia, or to a general "loss of tone." Iron in its many forms has been recommended, also arsenic in the form of Fowler's solution, or what is better still, in the form of cacodylate of soda, given intramuscularly. This is apparently very helpful.

Three to five grains can be given intramuscularly every second day until ten to fifteen doses are administered. Arsphenamin, given intravenously, as in the treatment of syphilis, has also been advocated, but there can be very little reason given for such specific arsenical treatment. The iodides are frequently given, as are many other remedies, with less reason for their administration. When the iodides are efficacious it might be well to accompany them with some preparation of mercury, as the case is very likely of luetic origin, or is associated with lues.

The treatment of polyarthritis in the acute form should be taken up promptly and followed through persistently; in the subacute and chronic form it will require in addition a great deal of patience on the part of both physician and patient. When one contemplates the distressing deformities and the permanent disabilities which may arise in difficult and neglected cases, on the one hand, and on the other hand, the satisfactory results which may follow when the case is favorable, and actually yields to treatment, he will not lack for an incentive.

GONORRHEAL ARTHRITIS.

The gonococcus as an infecting microorganism has certain well-marked peculiarities. It is known how limited its area of infection seems to be, as is shown in its invasion of the pelvic organs and the pelvic peritoneum, and how unusual it is for a general peritonitis to follow such an infection. It is also known how infrequently the gonococcus is recovered from the blood-stream, and how rarely it can be found in foci which occur after an acute gonococcal urethritis. That the disease does extend to other organs, as by continuity to the prostate, seminal vesicles, and other organs, has long been known, but its extension through the blood-stream was not definitely known until it was demonstrated by Thayer and Blumer,²² in Dr. Osler's wards at the Johns Hopkins Hospital, in 1896. The microorganism had been recovered from an infected joint some ten or twelve years before the work of Thayer and Blumer. It was found that such joint involvement may also follow gonorrheal ophthalmitis and vulvovaginitis.

The joint complication of this infection may occur soon, that is, within six weeks of the acute urethritis. Its frequency is reported by different observers as being anywhere from two to eleven per cent. of cases of gonorrhea. This percentage is much higher (twenty-five per cent.) in *recurring* attacks of acute gonorrhea. It occurs more frequently in the male than in the female. It may occur in children from a vulvovaginitis or from an ophthalmitis.

While it may occur soon after the primary infection, many joint conditions, presumably of gonorrheal origin, occur in later life or long after the acute infection has subsided or may have entirely disappeared. It is on account of this that such an arthritis after middle life assumes such importance in a diagnostic and therapeutic way.

BACTERIOLOGY AND PATHOLOGY.

As has already been stated, the lesion is due to the presence of the gonococcus in the joint. This is carried to the affected joint through the blood-stream and invades first the synovial membranes. It may also affect the tendon sheaths, and in some cases all the structures which enter into the making up of a joint, including the articular ends of the bones. The gonococcus does not enter the joint until the more violent local infection has subsided. Often the local lesion shows a marked and unexpected amelioration just before the joint complication occurs. It apparently remains in the lesion of the joint for only a short time, as it cannot be recovered after the acute stage has subsided. It does not remain in pure culture but for a few days, as it is soon accompanied with a mixed infection, which later largely determines the character of the process. Search for the gonococcus in the blood-stream or in the local lesion is therefore frequently futile. This is on account of one or both of two conditions: the culture may not be taken at the proper time, or the culture medium is not suitable or may not be properly prepared. It is a difficult microorganism to culture. After the gonococcus disappears from the lesion, other microorganisms, such as the staphylococcus, streptococcus, and other commonly associated organisms, remain to carry on the disease process.

The pathology of the joint infected with the gonococcus or with the associated microorganisms, does not differ greatly from that of arthritis already described as due to other microorganisms. The synovial sac is first affected and the contents become turbid. Depending upon the severity of the attack and the degree of mixed infection, the process may be of a mild type or it may go on to the surrounding tissues, producing suppuration, necrosis, and hemorrhage. Periostitis is by no means rare. The joint may recover, leaving very little evidence of the invasion, or it may become ankylosed partially or completely.

SYMPTOMATOLOGY.

Depending upon the character, extent, and distribution of the lesion, it seems desirable to classify clinically the various forms of gonorrheal arthritis.

Within four or six weeks after the acute local (nearly always urethral) infection takes place, there may be slight pains in the joints without any apparent local change. This may be characterized as merely a "joint pain," an *arthralgia*, or there may occur a redness and swelling of the joints and the surrounding tissues. This is associated with great pains and has all the evidence of an acute arthritis. It may be a single joint (monarticular), or it may occur in many joints (polyarticular). The opinion generally prevails that gonorrheal rheumatism is usually monarticular, in contradistinction to the many-joint involvement of acute rheumatic fever. It is true that in the case of a monarticular involvement the cause is more likely than not a gonorrheal infection; however, Cole and McCrae have found the number of joints involved in a gonococcus arthritis as compared with those of rheumatic fever as two to one. In the *acute form* there may be only a *serofibrinous* condition, the more common, or it may go on to a *phlegmonous* condition. In this there is usually a mixed infection. The process is quite rapid and destructive. The periarticular structures are involved. Surgical interference is nearly always necessary. In the large venereal wards of the Philadelphia Hospital, where the writer was resident physician some years ago, this form of gonorrheal arthritis was frequently observed. The joint

most frequently affected was the knee. The joints of the lower extremities are usually more frequently affected, but any joint is liable to the infection. The temperature and systemic effect in general is not so marked as in acute rheumatic fever. The tendency to sweating is not so in evidence. Endocarditis, while it may occur, is very rare. The convalescence is protracted, much beyond the time of acute rheumatism. A permanent deformity or destruction of the joint may follow. When the condition passes from an acute form to a *subacute form*, there is a tendency to a hydrops of the joint which may come and go on the least provocation. The true nature of this condition may be frequently overlooked, especially when it is impossible to obtain the history of a gonorrhea or to prove its presence.

The *chronic form* of gonorrheal arthritis must be considered in two different aspects. In the first there may be simply a continuation of the original infection to a chronic state, or as the result of recurring attacks of an acute urethritis due to repeated exposures. The joints may after a number of attacks become chronically inflamed.

It is contended by most observers that the patient having frequent attacks of gonorrhea is more susceptible to an arthritis and is likely to have it in the most severe form. These repeated acute attacks will lead finally to a chronic arthritis.

In the second aspect we deal with an entirely different condition of the joints. It probably should not be called a gonorrheal arthritis, but it is usually classed as such because there is a history of gonorrhea having occurred years ago, and on careful examination of the genitourinary tract the evidence of an old stricture, a chronic posterior urethritis, or a chronic prostatitis or vesiculitis may be found. There is usually no history of an arthritis, either acute or chronic, having immediately followed the former acute (but now long forgotten) gonorrhea. The condition comes after middle life and is more frequent in the male than in the female. It bears a close resemblance to the chronic polyarthritis due to a focal infection. Its symptoms and physical deformities are almost identical to those of a so-called rheumatoid arthritis or arthritis deformans. The distribution, however, is

different, in that it usually affects the joints of the lower extremities first. It is more likely to be monarticular, and it frequently affects the articulations of the pelvic bones as well as the vertebræ, especially the sacral and lumbar. It may have no other relation to gonorrhea except that the focus of infection was originally due to the gonococcus which had "closed its onslaught and abandoned the trenches in the form of a seminal vesiculitis, in favor of a mixed infection" (Thomas) consisting of various strains of streptococci, pneumococci, staphylococci, and perhaps colon bacilli.

As has been stated above, therefore, this form of arthritis should probably not be included in gonorrheal arthritis, but it is of such importance that it demands discussion here. An inflammatory condition of the joints, acute or chronic, should not be interpreted before a careful examination of the genitourinary tract has been made.

DIAGNOSIS.

By reason of the uncertainty of our knowledge of the cause of the arthritides in general, it should be refreshing from a diagnostic standpoint when a suspected case of gonorrheal rheumatism is about to be considered. The diagnosis will be based largely on the history of a gonorrheal infection, whenever that may have occurred. The history of the onset of the attack, the distribution and the peculiar behavior of the joints, are of a certain value. In men this may be a very simple matter, but in women the primary infection may be so mild as to be easily overlooked. It is not always possible to get a satisfactory smear for microscopic examination. It must not be forgotten that in children a gonorrheal ophthalmia or a vulvovaginitis may be the focus of infection.

On account of the usual unreliability of the history and of the occasional obscureness of the symptoms and physical signs, the diagnosis must frequently be concluded or at least confirmed in the laboratory. The laboratory should be of assistance in several ways. The easiest and most reliable is the confirmation which comes from a study of the morphology of the Gram-negative intracellular diplococcus in the secretion from the focus of infection, the urethra. This ex-

amination should be made in all suspected cases of gonorrhea and in all cases of arthritis where there is a suspicion of a gonorrheal origin. Another method which should be used more frequently is the *complement-fixation test*. According to Schwartz,²³ a positive complement-fixation test is an absolute indication of gonococcic infection somewhere in the body. This reaction should come about the fourth week after the onset of the infection. Other writers ascribe one hundred per cent. reliability to this test. The fact, of course, must not be lost sight of that a patient may be suffering from a double infection, that is, a patient with gonorrhea may also be suffering from acute rheumatic fever. A very simple laboratory test in suspected gonorrheal arthritis can be made by the injection of gonococcus vaccine. The reaction is not unlike the tuberculin reaction and can be done in very much the same way.

With the aid of one or other of these laboratory tests it should not be difficult to differentiate from certain other conditions which sometimes are confusing, such as acute rheumatic fever, polyarthritis due to focal infection, gout, sacroiliac strain, and tuberculosis and syphilis of the joints.

TREATMENT.

It goes without saying that prevention of a disease which is so destructive and disabling is highly desirable. The first plan of prevention is to prevent the original infection. This is a social as well as a medical problem which is too large to discuss here. The second plan is to treat the patient for the local lesion as early as possible and along the most approved lines. This also is in part a social problem, for the physician cannot treat the patient until he presents himself for treatment. On account of the nature of the disease and the manner in which it is usually contracted and the stigma attached thereto, the patient naturally keeps away from the doctor as long as he can. It should, therefore, be the duty of the physician or the profession in general, to educate the public so that the individual will apply early for relief when the infection occurs. This is a large and almost uncultivated field for the real public health physician. One might conclude that by this prompt treatment gonorrheal

rheumatism might be stamped out, but unfortunately this is not the case. Many cases have been reported where the treatment for gonorrhea was early and apparently efficient, and yet later gonorrheal rheumatism developed. Also it has been noted that the severity of gonorrheal rheumatism is apparently not at all dependent upon the degree of the severity of the primary infection. However, it seems reasonable to expect that early, careful, and persistent local treatment should lead to a reduction of the incidence of gonorrheal rheumatism.

Aside from prophylactic measures, the treatment of gonorrheal arthritis depends upon the acuteness of the infection in the joints, and also upon the stage of development of the local or original infection. In all cases the original focus must receive consideration, but the character of this treatment will depend upon the acuteness or the chronicity of the local lesion.

If arthritis develops early, or when there is still a rather acute urethritis, for example, the treatment of the urethritis should be carried out very carefully. Any traumatism may result in more joints being involved, because of the possible septicemia. The treatment of the local parts should, therefore, be mild so as not to irritate the mucous membranes. There should be no unnecessary instrumentation, and no irritating application made. If, on the other hand, the attack of arthritis should occur late after the original infection or when it has already become chronic, stimulating treatment may be very beneficial. It will result not only in healing the original focus, but it may result in delivering to the blood-stream sufficient autogenous vaccine to have a beneficial effect on the lesion in the joints. In the chronic cases, as well as in the acute, the local treatment of the original focus of infection should be persistent until every vestige of the infection is overcome or removed. The necessity for radical treatment of gonorrheal salpingitis at the proper time has long been recognized and practiced, but a gonorrheal vesiculitis which does not yield to medical treatment is usually allowed to continue until some serious complication has arisen. Fortunately the modern genitourinary surgeon is well aware of his responsibility in this matter, and it is

encouraging to note the results. A competent genitourinary surgeon should be consulted in all cases of gonorrheal arthritis.

Next to the importance of treating the seat of the initial infection is that of caring for the affected joints and of administering such internal medication as may be indicated.

The local care of the joints will depend upon the character of the lesion. An irritative arthritis or "arthralgia," may be satisfactorily cared for by applying compresses soaked in a saturated solution of sulphate of magnesium, or of boracic acid, or of lead water and laudanum, and by having the patient rest the part. A fibrinous arthritis may require very little in addition to this, except a fixation splint as in an ordinary arthritis. However, inasmuch as the tendency to ankylosis is quite definite, it is well not to fix the joint for a long time, or as long as one would in an ordinary joint infection. In a phlegmonous or purulent arthritis it may be necessary to aspirate the joint, or to open the joint freely and establish drainage. When the indication for drainage is evident it should be done promptly and thoroughly so as to avoid destruction of the joint.

There is no specific remedy. The internal medication or constitutional treatment, is rather unsatisfactory, as will be perceived by the many medicines which have been suggested. The treatment is therefore largely symptomatic. The one symptom which requires the greatest consideration is *pain*. This may be met by a liberal administration of the salicylates, very much as in acute rheumatic fever. Benzoate of soda has been advocated by some authors as being efficacious. In fact, it has been suggested as a point in differential diagnosis between acute rheumatic fever and gonorrheal rheumatism—in the first the salicylates are most likely to relieve the pain and in the second, the benzoates. This has not been the experience of the writer. When the pain is severe, opiates are necessary. The iodides and mercury have been used in small doses with reported success. One must be inclined to feel that in those cases in which the iodides and mercury have been found helpful or curative, there must have been also an infection with the *Spirocheta pallida*.

As stated above, no so-called, specific remedy has yet been found; many have, however, been suggested and tried, with usually unsatisfactory results. Among these the remedy which seemed most likely to be satisfactory is the specific vaccine treatment. The use of the specific vaccine in the treatment of gonorrhea seems to be amply justified—many successful cases have been reported. Its use in gonorrheal arthritis has not, however, proven satisfactory. The reasons for this seem quite obvious. It has already been stated that the gonococcus does not remain in the affected joint during the whole time of the disease, that it soon dies out and a mixed infection remains. It would seem, therefore, that a polyvalent vaccine should be more satisfactory, but this is not as efficient as it is in a general polyarthritis. Evidently the damage already done to joints' structure by any micro-organism cannot be removed by vaccine treatment.

The work of Victor Vaughan, on the behavior of the protein split products, has brought new interest to treatment with non-specific vaccines, and many contradictory reports are resulting. The writer has used typhoid vaccines in some of the cases of gonorrheal arthritis and has had most profound reactions. The results in these cases were not satisfactory, and did not warrant a continuance of the treatment.

Whatever treatment is undertaken, to be successful, must be continued for a sufficient time to permit results, as the process of recovery is naturally slow. The patient should be warned against fresh infection.

To conclude: *Acute gonorrheal rheumatism* should be treated by a careful, thorough and prompt treatment of the focal lesion; by complete rest of the joint or joints involved, and by the administration of salicylates, and, if necessary, opiates in sufficient dose to control the pain. *Chronic gonorrheal rheumatism* should be treated as a polyarthritis and in the same manner as those due to the ordinary infections are usually treated. This is described in the chapter relating to such a condition. In both acute and chronic gonorrheal rheumatism the specific vaccine may be tried with benefit, and in the chronic condition the protein split products, such as typhoid vaccine, or horse serum, may be used to advantage.

SYPHILITIC ARTHRITIS.

INTRODUCTION.

Syphilis of the joints has not, until very recently, received from the internist the consideration which it demands. When the diagnosis of general syphilis is established, any special manifestation such as a lesion of the joints is generally accepted as an expected complication and very little special reference or attention follows.

Most information in the present literature upon this subject comes, therefore, from the syphilographer, or from the orthopedist and the general surgeon.

There are two notable exceptions to this treatment. They are: *First*, the early writers (those in the times of John Hunter and immediately following) have given most accurate descriptions of the syphilitic joint, even though the direct relation between syphilis and diseases of the joints was not generally accepted; and *second*, more recently or since the discovery of the germ of syphilis and the introduction of the more accurate methods of diagnosis, the literature of syphilis gives evidence of more careful consideration of the syphilitic lesion of the joints.

The orthopedist, with the aid of the roentgenologist, has also been a great aid to the internist in this, as in other of the arthritides, in the study of syphilis of the joints. There is now no longer any doubt that syphilis has a direct influence in causing disease of the joints, and the early contentions of Lancreau and Virchow are definitely confirmed in the more recent knowledge of syphilis.

Syphilis of the joints is not a frequent lesion, but in the consideration of disease of the joint it should always be kept in mind. Especially is this true in the obscure joint affections of children. O'Reilly²⁴ says between nine and ten per cent. of all cases seen at the orthopedic clinic of Washington University Hospital, St. Louis, have been joint syphilis, also that in children with joint disease the incidence of the syphilitic joint may be as high as twenty-five per cent. According to Hutchinson, in the inherited form of syphilis it may occur

soon after birth, though it is probably more frequent between the ages of seven and twenty years. It may present an epiphysitis in the young infant, or later in life it may occur as a chronic effusion associated with very little pain, in one or more joints. In this form it is usually preceded by an interstitial keratitis, and by gradually oncoming pains, not severe, but worse at night—"growing pains," as designated by the unsuspecting mother. It may be spoken of first, before the lesion is definite, as an *arthralgia*, which is no doubt akin to the condition frequently occurring early in the secondary stage when there are general muscle and joint pains without any apparent localizing manifestations.

Syphilis of the joints, producing extensive pathology, is more frequent in individuals of adult or middle life, though it may also occur in the aged. There is a manifestation of the joints in early syphilis, contracted at any age, which is scarcely worthy the name arthritis, but which will be considered in the classification of this affection. And there is also that lesion called *Charcot's joint*, which is undoubtedly of trophic origin, associated with a syphilitic lesion of the spinal cord. It usually comes late in the course of syphilis and may precede the first symptoms of tabes dorsalis.

While it affects the joints, such as the knee, elbow, or shoulder, it is not in the strict sense the result of a direct infection of the joints, and will, therefore, not be considered except insofar as the differential diagnosis may be concerned.

CLASSIFICATION.

Aside from the conditions to which brief reference has already been made, namely, joint changes due to inherited syphilis, the arthralgia of early syphilis, and the Charcot's joint, there are definite manifestations in the joints of adults and in those of middle life and old age which may be classified as follows:

1. Acute synovitis.
2. Chronic synovitis.
3. Subacute and chronic synovitis associated with intra- or peri-articular gummata or with an osteoarthritis.

This classification is suggested by the writer as it seems to represent more clearly what can be differentiated clinically.*

PATHOLOGY.

In the *congenital* form there may be an acute epiphysitis, which occasionally goes on to suppuration. It may occur in more than one joint. This is usually in infants. In older individuals there is more likely to be a chronic effusion, which may affect several joints, and is generally symmetrical.

In the *acquired* form there may be an acute synovitis, which cannot readily be distinguished from an ordinary acute arthritis. This may pass on to a serofibrinous stage. A chronic hydrops may result.

The characteristic pathological lesion of the syphilitic joint, however, is the gummatous formation which may occur in the synovial sac or in any of the joint structures. There may also be an osteitis, or a periosteitis, in direct relation to the joint. The gummatous formation may break down into the joint, but more frequently it affects the cutaneous surface. These advanced lesions are most frequent in the knees or the elbows, though they may occur in some of the smaller joints. The sternoclavicular joints are occasionally affected, producing a localized swelling which is quite characteristic. An inflammatory condition of the articulation formed by the manubrium and the gladiolus has long been considered as highly suggestive of syphilis.

SYMPTOMATOLOGY.

During the secondary stage of syphilis general pains throughout the body are a common symptom. This may be the first evidence of an arthritis, but not infrequently it is only a symptom of a general infection with no localizing

* Hutchison (A Lecture on Syphilitic Joint Diseases, British Medical Journal, Vol. I, 1892, page 797) gives the following clinical-pathological classification:

1. Synovitis during the secondary stage.
2. Perisynovial gummata.
3. Arthritis due to osseous nodes or gummata in the neighborhood of the joints.
4. True chronic synovitis.
5. Syphilitic chondro-arthritis (Virchow).

symptoms. This may occur with or before the appearance of the secondary skin eruption.

When there is a definite acute arthritis the pain localizes at one or more joints. These are usually the knees or elbows, or occasionally the shoulders, ankles, and wrists. These are in the main the joints which also are most likely to be involved with the tertiary lesion. No joints are immune. The sternoclavicular joints have been mentioned. With the pain comes swelling and the evidence of effusion. It constitutes an acute synovitis. The pain may not be severe, and is characterized by being worse at night. The effusion is not marked, and there is seldom any discoloration of the skin. There is no great soreness or tenderness, and the joint may be moved with considerable and surprising ease. Fever and sweating are usually not present. The effusion may also be met with in certain bursæ or tendon sheaths. The symptoms disappear much more readily than in the ordinary polyarthritis or in gonorrheal arthritis. Certain cutaneous nodules, especially on the extensor aspect of the joint, may appear.

In the case of a chronic synovitis, the swelling and stiffness may occur with little, if any, pain. The effusion is greater and usually varies from time to time without any apparent cause. It may follow the acute form, however, but it usually occurs later and is not preceded by an acute stage.

With this hydroarthrosis, or without it, a rather painless, irregular swelling of the joints may occur. This is the characteristic syphilitic joint. It is usually the knee, and is likely to be unilateral. The swelling is out of all proportion to the discomfort or loss of function. Parts of the swelling may be movable, but manipulation does not cause any great degree of discomfort. The gummatous process which is responsible for this particular condition may break down and involve the synovial sac or may involve the skin, producing an irregular external lesion. If the gummatous process has involved the bone, or if there is an osteoarthritis, the joint is usually large and irregular, and probably more painful and tender. Regardless of the extent of the lesion, the subjective symptoms are remarkably mild. Unless treatment is instituted the lesion will continue for an almost indefinite time.

DIAGNOSIS.

The lesion is so characteristic that a diagnosis should not be difficult. However, because of the irregularity and apparent lawlessness of the syphilitic lesion in general, the manifestations of syphilis of the joint may be quite misleading. In all obscure joint lesions an attempt should be made to get the history of syphilis, and a Wassermann test should be done. If the Wassermann reaction is negative and there is yet a suspicion of syphilis, specific treatment should be instituted as a therapeutic test. When this is undertaken, it should be with great thoroughness, for it is quite common for a chronic syphilitic arthritis to be present and the Wassermann test to be negative. This is illustrated by the occasional experience one has with a chronic syphilitic who has gone the rounds of physicians and has had just enough mercury and iodides to prevent a positive Wassermann, but not enough to prevent a definite lesion of the joints or elsewhere.

An x-ray examination may be of assistance, but this is often disappointing, unless there is a syphilitic process of the bones in relation to the joint. Under such circumstances the roentgenological examination will reveal the characteristic osteochondritis or osteoperiostitis. In advanced cases the x-ray may show destruction of bone and cartilaginous tissue.

The condition should be diagnosed from *acute rheumatic fever*. The acuteness of the course, the local distribution, the fever and sweats, the severe pain, and the beneficial effect of the salicylates, in acute rheumatic fever should be sufficient to make the differentiation. It should be diagnosed from so-called *arthritis deformans*. The symmetrical distribution in the small joints, the acute exacerbations, the local redness and stiffness, with severe pain, also the peculiar deformities, such as "silver fork" and ulnar deflection of the hands, should mark the difference. There is scarcely, if ever, "lippping" of the margin of the bones in syphilitic arthritis.

It should be differentiated from *sarcoma* of the joint, by the rapid growth of the tumor and the negative Wassermann. X-ray examination should be of some assistance in differen-

tiating from the above mentioned diseases, but a careful physical examination, following a comprehensive history and an intelligent interpretation of the Wassermann, are more to be depended upon.

TREATMENT.

The treatment of syphilitic joints demands persistent use of the remedies ordinarily employed in the treatment of syphilis in general. The arthralgia of the secondary stage is best overcome by giving mercury, or arsphenamin, or both. The extensive joint involvement will be favorably affected by using in addition to these remedies, the iodides in large doses. This treatment should be continued until the joint is restored. Unless there is definite destruction of certain of the joint tissues, a cure can be reasonably expected. A systematic checking up with a Wassermann test will prove satisfactory, during the course of the treatment. Rest and fixation splints, together with such local applications as are usually employed in an ordinary arthritis, are, of course, helpful. When there is considerable effusion into the joint and antisyphilitic treatment with rest and pressure are not successful, drainage may be necessary.

TUBERCULOUS ARTHRITIS.

INTRODUCTION.

This is largely a disease of children and also is generally agreed upon as being a surgical disease. The exceptions to this statement are that it not infrequently is found in adults, and that while it is conceded to be a surgical disease, it is a fact that the employment of operative procedure in these cases is not so frequent as it was some years ago. There is some justification, therefore, for a discussion of tuberculosis of the joints from the standpoint of the internist who deals largely with adult patients or with those who have passed middle life.

It is a chronic disease with occasional acute manifestations. It affects in the order of frequency, the spine, the hips, the knees, the ankles, shoulders and wrists. By far the most frequent location is in the spine (Pott's disease),

in the hips (hip joint disease), and in the knees (white swelling). These manifestations of the disease have been recognized almost from the earliest records of man. The cause, however, and its relation to tuberculosis in general is only of recent date.

The tubercle bacillus is brought to the joint by the blood-stream or by extension from a lesion in the vicinity of the joint. It is now generally agreed upon that the micro-organism gains entrance to the body largely with the food, by way of the digestive system. If not in all cases, at least in the great majority of cases, the lungs and the lymphatic system are first infected and the joint infection is secondary to this. In children there is probably more reason for thinking that the infection may be primary, whereas in adults it is most likely to be secondary to a pulmonary involvement. While the interpretation of pain in the joint should always be a matter of importance, in an adult who has a known tuberculous lesion of the lungs, either healed or active, the possibility of a tuberculous process should receive careful consideration. Not infrequently an injury to the bone or joint, of the slightest nature, may appear to be the immediate cause of the disease.

PATHOLOGY.

The process usually begins in the cancellous portion of the bone which enters into the formation of the joint. There is a rapid caseation following the formation of tubercles, and a breaking down of bone tissue which soon extends into the cartilages and finally results in miliary tubercles being scattered over the synovial membranes of the joint. This is followed by an effusion which in itself is not very extensive. Later, on account of the bone destruction, there is an apparent atrophy of the joint. Fistulæ occur, from which there is either a purulent or a sanguineous, watery discharge, with occasional spicules of bone. In some cases the disease may begin more acutely with primary tubercles on the surface of the synovial membranes of the joint.

Depending upon the location there is a characteristic deformity. In the lower dorsal vertebræ, and also in the lumbar, on account of destruction of the bodies and the super-

imposed weight of the body, there is angulation and the protrusion of a "knuckle." In the upper dorsal region, on account of fixation by the ribs, there may be little deformity, and in the cervical vertebræ the first effect may be a torticollis. Always there is the possibility of a "cold abscess," which may burrow along the sheaths of tendons and muscles in the immediate vicinity. Thus arises the psoas abscess. The hip may become dislocated and the leg finally shortened. The knee is drawn up so as to relax the tendons and ligaments, when this joint is involved. The pathological process is practically the same in all joints.

SYMPTOMATOLOGY.

Usually the localization of the lesion is preceded by a decline in general health, with loss of weight. With this, localized pain is experienced, which is associated with muscle spasm, depending in character upon the seat of the lesion. The pain is usually referred in such a way as to be particularly misleading. If the lesion is in the vertebræ the pain may be referred to the abdomen, and if in the hips it may be referred to the knees. The pain is usually worse at night, but not so markedly as in syphilis or secondary cancer. In children the pains at night result in the so-called "night cries." The pains are wearing on account of their regularity and constancy, and the patient loses sleep, loses his appetite, and takes on the appearance of serious illness. There may be an elevation of temperature, but this does not occur until for some reason or another the infection becomes a mixed one. The pulse becomes rapid. Blood examination will show only a secondary anemia, not necessarily a leucocytosis.

The local symptoms are pain and tenderness over the joint. There is redness, providing the lesion is not too deeply buried in the joint structures. If the lesion is superficial, as in the ankle or wrist, there is a slight blush, but no great amount of swelling. There is a tendency to local necrosis and fistula formation. On account of the deep location of the lesion and the tendency to burrow, the swelling and redness may occur at some distance from the original lesion, as in a psoas abscess, pointing below Poupart's ligament, when the lumbar

vertebræ are diseased. Limitation of use of joint, especially in a child, is highly suggestive.

The more common and easily recognized symptoms of pulmonary tuberculosis are usually not in evidence in a case of tuberculous arthritis.

DIAGNOSIS.

The symptoms of pain in a single joint in a child, especially if it be in the knee or hip, should make one suspicious of tuberculous arthritis. With such a lesion in mind every effort should be made to confirm or disprove the diagnosis. The symptomatology given above will lead one to an undoubted diagnosis, but except for the pain, most of the symptoms occur late, or after the disease has done almost irreparable harm. It is very necessary to make the diagnosis early in these cases. To do this, x-ray examination by a skillful roentgenologist is of the utmost importance. This should be done as a matter of routine. It is surprising how valuable this procedure is in the diagnosis of an early lesion. This is particularly true in spinal and in hip joint disease. The primary focus in the bone can be made out long before the other symptoms besides pain appear. The importance of this from the standpoint of treatment cannot be overestimated.

Very helpful in the diagnosis is, of course, the discovery of a tuberculous focus in other parts of the body, such as in the lungs. If this verification cannot be made, and if the x-ray examination does not give positive findings, a hypodermic injection of Koch's old tuberculin, 0.001 to 0.002 cubic centimeters, should be employed as a test. Very little harm can come from such a test if the case is carefully selected. Disturbance of temperature must be carefully interpreted.

The condition must be diagnosed from *syphilis*, congenital or acquired. In this the Wassermann test, with proper interpretation, is exceedingly helpful. In the adult, particularly, the possibility of a *gonorrheal arthritis* is to be considered, and in all cases *sarcoma* of the bone as well as an *osteomyelitis* must be kept in mind.

It has been the experience of the writer that in adults tuberculous arthritis is more likely to be overlooked than in

children. Especially is this true if the lesion happens to be in the upper portion of the spine. A routine and intelligent use of the x-ray should be of great assistance in these obscure cases.

TREATMENT.

It is not the purpose to enter into a discussion of the surgical treatment of tuberculous arthritis, except to emphasize again in particular the necessity for rest of the joint. This is done with various splints, or with extension, procedures which are well known and established.

Before beginning a treatment there should be a definite understanding with the patient or the parents of the patient, relative to the probable length of time for the treatment and the necessity for coöperation on the part of all. It means a course of one to two, or even five years, and it means, if the case is met early and there is perfect compliance, that the patient will undoubtedly get well. All encouragement should be given after the patient once expresses his willingness to follow the course. With this, every attempt should be made to improve the patient's general health by following such hygienic and dietetic treatment which occur to the intelligent physician. Fresh air and sunshine are absolutely necessary. If the sick room is not open to sunshine the patient should be moved out daily if possible. The local effect of the direct rays of the sun upon a tuberculous lesion, especially of the joint, is well recognized. There are places where this can be carried out in more satisfactory detail, such as in some of the cures established in the Swiss and Italian Alps, but it should not be forgotten that heliotherapy can be instituted wherever the sun shines, and this both in winter and summer time. This treatment, to be successful, must be systematized. An occasional exposure to the sun for varying time is of no particular benefit, but when given daily for definite periods it is of great value.

The food should be nutritious and appetizing. Cod-liver oil should be a part of the diet. If it cannot be taken as food it should be given as medicine. Iron and arsenic with malt may be given from time to time. Because the patient leads such an inactive life the regularity of the bowels should

be made a matter of great care. Tuberculin treatment may be instituted, but in comparison with the measures already mentioned it is not of great value.

By following such a course it is remarkable what can be accomplished in even a late case. The experience of the patient and the occasional checking up with x-ray examination will give abundant evidence of the satisfactory progress towards the cure of the disease.

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Gout

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Gout.

(Podagra; Arthritis Urtica; Goutte; Gicht.)

GOUT is a constitutional disorder, frequently inherited, due to faulty metabolism and functional inferiority of the kidneys; in which the amount of uric acid and other purin bodies in the blood and tissue fluids is increased and specific inflammation of the joints with deposition of uratic salts in certain affected structures takes place.

HISTORICAL.

If one is to acquire the proper perspective for an intimate study of gout one cannot do better than search out the earliest recorded statements upon the subject and learn of the additions to this knowledge as the general advancement of learning and scientific progress have made such enlightenment possible.

Gout can be truly said to be a very ancient as well as a modern enemy to mankind. Clifford Allbutt writes that, "of all maladies gout has perhaps the longest and most worshipful pedigree," while Ewart, in discussing the antiquity of the disease, states that "it is certainly as ancient as civilization."

It is interesting to note that in the accounts of the disease handed down from the remote past, the theories concerning the etiology, the accounts of the leading symptoms and the general ideas concerning the essentials in treatment were practically the same as exist in the modern treatises upon medicine.

All authorities agree that gout has been from the beginning and still is practically unknown in those countries where the inhabitants obtain a livelihood by means of their own exertions, and especially if they subsist upon simple fare undiluted by alcoholic beverages.

Medical history teaches us that gout is not only a disease of great antiquity but it is acknowledged to be one of the earliest forms of bodily disorder that mankind acquired when

indolence, intemperance and luxurious living replaced the laborious days and simple foods and pleasures of our early ancestors.

Hippocrates (460 to 370 B.C.) refers to the "unwalkable disease," and his clinical description of the disorder is accepted by authorities as proving that the entity described was true gout.

Cicero (106 to 43 B.C.), himself a sufferer from the disease, mentions gout as a common disorder throughout the Roman Empire, while Celsus, Pliny and Seneca (first century A.D.) give excellent descriptions of the malady and state that its prevalence was due to luxurious living, all kinds of debauchery and to the lack of suitable exercise.

We know from Lucian (120 to 200 A.D.), the brilliant Grecian poet, that the physicians of his period gave various names to the entity that we now term gout according to the part of the body affected. The term "podagra" simply indicated that the foot was the seat of the painful affection while if the hand, knee, shoulder or elbow was involved the terms "chiragra," "gonagra," "omagra," or "pechyagra" were used.

Thus the term "foot seizure" or "foot ail" similarly indicated the most characteristic symptom. Sir Dyce Duckworth states that it is probable that the earliest English (Saxon) name for gout was "fotadle" or "foot addle" the term "adle" being a synonym for ailment.

The term gout was first used by Radulfe near the close of the thirteenth century. It has been thought that the name was derived from the Latin "gutta," a "drop." The ancient theory concerning the etiology of the disease was that it was due to the presence in the blood of some peculiar humor which, under certain conditions, "dropped" into the joints. Trousseau wrote of the word gout: "It is an admirable name, because in whatever sense it may have been originally employed by those by whom it was invented, it is not now given to anything else than that to which it is applied."

The earliest theories concerning the etiology of gout are interesting and reveal all too truly the extreme slowness of medical progress.

Galen (131 to 201 A.D.) believed that the disorder was due to "thick and morbid humors" in the blood and realized perfectly that the disease was frequently hereditary. He felt that the gouty deposits (tophi) were the result of desiccation of "mucus, gall and blood" (Neuburger) and he was familiar with the diathetic relationship between calculus and gout (Garrison).

Soranus (second century A.D.), who is the authority on the gynecology, obstetrics and pediatrics of antiquity, writes with no uncertainty regarding the clinical manifestations of gout and ascribes the cause of the disease to over feeding and under exercising.

Aretæus (second century A.D.), who, to again quote Garrison, "ranks next to Hippocrates in the graphic accuracy and fidelity of his word pictures of disease," gives an excellent account of the mode of invasion of gout and makes a special point of the tendency to involve the larger joints in later attacks of the disorder. This author mentions too the reluctance which the victims of gout display in assigning the malady to its true cause—their own excesses—naturally preferring to attribute the illness to an injury or other cause.

Caelius Aurelianus, the fifth century neurologist, writes of Erasistratus, the famous Alexandrian anatomist, treating King Ptolemy for gout by restricting his diet.

J. Mason Good states that gout was one of the maladies which was common in England in its earliest ages of barbarism. It was frequently referred to by the Anglo Saxon historian under the term "fot adl." We learn from the references quoted, therefore, that gout was a common disorder in ancient days but it is not to be expected that the diagnosis was any more accurately made formerly than in our own time.

It is scarcely necessary to point out that many other forms of arthritis such as the infective forms, or Neisserean and luetic manifestations were probably mistaken for gout as is true in modern medicine.

It is interesting to note that the majority of the ancient writers agree that gout was produced by over eating and by drinking alcohol to excess. They felt that under the influence of a life of ease, particularly when suitable exercise was lacking, the "morbid humors" were generated in the blood and at

stated intervals there was a precipitation of these humors into or about the joints.

Alexander of Tralles (525 to 605 A.D.) was of the opinion that there were many varieties of gout. Some were due to the effusion of blood into the joints and others to the extravasation of bile or other fluids between tendons and ligaments. He recommended, in addition to careful dieting and suitable exercise for the patient, that the affected joints be rubbed with an ointment containing ammonia and turpentine in order that the tophi should be dissolved.

Paul of Ægina (625 to 690) had what might be termed very modern views regarding gout for he was sure that the disease was frequently mistaken for other common joint affections.

One of the medical pioneers in the field of chemistry was Paracelsus (1493 to 1541) who was one of the first to look upon certain disorders as diathetic in nature. Garrison states that Paracelsus regarded both gout and the formation of stone as "tartaric processes" caused by the precipitation of substances that were normally voided from the body. This is the first recorded attempt of ascribing a chemical etiology to a disease process. In 1643 the word "rheumatism" was introduced into medical science by Baillou who differentiated it from gout and from other forms of arthritis. In 1683 the English Hippocrates, Sydenham, wrote a treatise upon gout that still remains one of the best descriptions of the disease. As Sydenham was a victim of the disorder for many years it is not strange that his account of the malady should be graphic, accurate and forceful. Boerhaave (1668 to 1738) was of the opinion that gout was contagious and the same idea was maintained by Van Swieten.

Among the first to dispute the long held view of the humoral pathology of the disease was William Cullen (1712 to 1790) who, in 1784, promulgated the theory that gout was a disorder of the nervous system. Cullen admitted that the tissue fluids of the patient's body became changed in gout, but he felt that this was a result of the malady rather than its cause. Cullen's high place in English medicine caused the "nervous theory" to become popular despite the fact that Scheele had discovered uric acid in the urine in 1776 and that

Wollaston had proved in 1797 that gouty and urinary concretions contained uric acid.

Following these discoveries many physicians began to regard gout as a disease intimately connected with the presence of uric acid although it was not until Sir Alfred Garrod demonstrated in a series of studies, during the period from 1848 to 1854, the relationship between uric acid retention and gout that the, so-called, chemical theory of the etiology of gout became popular.

The demonstration of the presence of uric acid in the blood by the use of the very simple "thread test," by Garrod greatly interested the medical profession and further influenced the adoption of the chemical hypothesis regarding the etiology of the disease.

As early as 1854 Gairdner held that the disappearance of urea and uric acid from the urine and their accumulation in the blood was but a symptom of gout and in no way explained its cause.

It was Gairdner's thought that there was some obscure nerve influence at work. Barclay, in 1866, advanced the view that the primary change in gout lay in the blood corpuscles that were deleteriously affected by the action of the "gout producing elements" circulating in the blood stream.

A novel theory was introduced by Ord in 1872, *i.e.*, that there was an inborn tendency for the fibroid tissues of gouty subjects to undergo a special type of degeneration and Ebstein's experimental study substantiated the view that there was a disturbance of tissue nutrition apparently brought about by the irritant action of sodium urate in the tissue fluids. Murchison, Latham and others were of the opinion that gout was the result of a functional disturbance of the liver which caused a condition of lithemia. That the condition was "nervous" in origin was advocated, in 1873, by Living. Sir Dyce Duckworth, in 1880, gave as his opinion that gout was a "primary neurosis," a functional disorder of a definite tract of the nervous system due to a central neurotic taint, and originating as the result of prolonged toxemia.

Garrison indicates in his admirable History of Medicine that the aid of the physiological chemist was invaluable in further studies concerning gout. He points out the important items

of progress in such works as Marcet's discovery of xanthine (1819); Stecker's demonstration of the same substance in the urine (1857); the discovery of the "family tree" of gout by Emil Fischer during the period from 1879-1895 when this great chemist demonstrated the purin nucleus as a sort of germ plasm common to all the metabolic products of the disease and made extensive studies upon the synthesis of proteins from their amino-acid constituents; Kossel's proof that xanthine bases are derivatives of the urine (1879); the determination of the true formula of nucleic acid by Schmiedeberg (1896); Kossel's classification of the nucleins; Horbaczewski's synthesis of uric acid in vitro (1882) and his proof that it is derivable from nuclein (1889); Minkowski's discovery that a diet of xanthine bases will increase uric acid excretion (1868), that, in birds, the uric acid is synthesized in the liver through the influence of lactic acid (1886); and the relation of the liver to metabolism was studied to advantage by the Russian physiologist, Eck, in 1877 and much new light thrown upon this very complex subject.

In the latter years of the nineteenth century, Chalmers Watson, Gore, Minkowski and others propounded the theory that gout was the result of a chronic infection. Their idea was that a toxin was formed within the intestine as a result of an infection by bacteria and that this toxin acted upon the blood in such a way as to cause gout. In 1905 Trautner came to the conclusion that the *Bacillus coli communis* was responsible for the production of gout.

During the past forty years there has been a growing feeling that in a study of the metabolic relations of proteins will come the solution of the mystery of the cause of gout.

Although the majority of authorities feel that uric acid, its formation and excretion or lack of excretion, explains many factors of the disease; many other observers feel that there is a definite relation between local foci of infection and gout.

Infected teeth, pyorrhea alveolaris, infected tonsils and sinuses, chronic infections of the gall bladder, appendix and other regions of the body are often thought by certain clinicians to be the primary focus in bringing about the disease.

Llewellyn, in a recent comprehensive work about gout, gives as his conclusions concerning the etiology of the disorder the following factors;

(1) The majority of the cases of gout reveal the presence of local foci of infection.

(2) The local foci of infection should be regarded not as symptomatic of, but etiologically related to, gouty arthritis.

(3) There is inherent abnormality or instability of nuclein metabolism, conjoined with an enhanced tissue affinity or increased retention capacity for uric acid.

(4) These latent tissue peculiarities, through the agencies of infections or sub-infections (the presence of microbes that do not set up a focus of infection) become manifest as gout.

(5) The organism or organisms excite inflammatory reaction with sequential uratic deposition, either of articular or ab-articular site.

(6) The predilection of such uratic deposition for certain peculiar tissues is determined by their greater content of sodium ions as compared with the blood.

(7) The local and general phenomenon of gout, its paroxysmal nature and tendency to periodicity, are most readily explainable on the basis of the presence of a chronic infection supervening in a subject the victim of those innate peculiarities of tissue with their correlated obliquities of function which we term the "gouty diathesis."

GEOGRAPHICAL DISTRIBUTION.

As a rule, gout is found indigenous only in the Temperate Zone. Stanley found that the natives of Africa never suffered from its effects but the more prosperous negroes of the United States are by no means immune. In China and Japan the disease is rarely met with except among the wealthy classes in the large cities.

Where there are leisure classes with luxurious habits the disease is to be found. These conditions are usually found in the larger centers of population where the well-to-do citizens fail to earn their bread by the sweat of their brows.

It is a common statement that there are more cases of gout in England than in the rest of the world. It is not to be

forgotten, however, that English physicians are perfectly familiar with all varieties of the disease and, therefore, seldom fail to recognize it while physicians in other parts of the world being less familiar with its characteristics often fail to recognize even the tophaceous variety.

The disease is also common in Holland, Belgium and France and was beginning to be frequently observed in Germany during the twenty years that preceded the great war.

In Canada, Australia and South Africa it is found that gout is increasing, while in the United States it is certainly increasing in certain sections. It is to be remembered that the English colonies as well as the United States will receive many emigrants from England—the home of gout—during the next few years and that many of these individuals will bring with them a gouty heritage. We can expect to see more gout in the future than we have been accustomed to find in the past.

INCIDENCE.

The statement is often made that gout is a rare disease in North America, but a truer statement is that the disease is frequently overlooked and its symptoms and signs misinterpreted.

Futcher well says that: "If physicians will recognize the fact that there is, probably, no such affection as chronic rheumatism, and that the vast majority of cases of chronic arthritis are either gout, arthritis deformans, or some other form of infectious arthritis, it will be found that, with due regard to the points in differential diagnosis, a great many more cases will be justly attributed to gout than in the past."

There were ninety-two cases of gout diagnosed among a total of thirty thousand eight hundred and seventy-one medical admissions in the Johns Hopkins Hospital in twenty-four years, or 0.29 per cent. A comparison of the number of cases in the above hospital and in St. Bartholomew's Hospital, London, shows that the ratio was just two to three. When we consider that gout is more prevalent in Southern England than anywhere in the world, it indicates that North America has its share of patients suffering from gout.

Williamson studied a series of one hundred and sixteen cases in the Cook County Hospital of Chicago, during six

years, which is the largest series of cases ever reported from an American Hospital. The ratio of admissions from gout to total medical admissions in the hospital was four to ten, which is a higher percentage than that reported by other hospitals in America.

Pratt states that only forty-one cases diagnosed gout were treated in the medical wards of the Massachusetts General Hospital between the years 1821 and 1916, and McClure found only thirteen cases of tophaceous gout among the first eleven thousand medical admissions to the Peter Bent Brigham Hospital, Boston.

The writer has been much impressed in talking with various physicians at the number of cases of acute gout that are under treatment. The large number being treated at home is in marked contrast to the very small number encountered in hospital wards.

Another impressive difference is the number of cases of "chronic rheumatism" met with in dispensary work who exhibit typical tophi, and frequently give a history of typical arthritic gout, who have never been admitted to the ward but who have been content to remain at home during the acute seizure. In questioning patients concerning former deposits of tophi, they frequently mention former salty deposits in the ear or over the knuckles or toes that have "dropped out" or have been removed. One cannot but be impressed with the fact that gout is not uncommon, but that it is diagnosed as such less often than it should be.

ETIOLOGY.

PREDISPOSING CAUSES.

Heredity. From the earliest days of written medical history gout has been looked upon as a typical example of a disease transmitted by consanguinity. A family history of gout can be elicited in a very large percentage of gouty patients among the educated classes. Some authorities state that, in their opinion, the disease is always inherited. Although this statement may be entirely true, proof of its accuracy is difficult to obtain. Authorities agree that in from 40 to 75 per cent. of gouty patients met with in private practice a family history

of maladies that may easily be interpreted as gout can be obtained. In hospital statistics the hereditary factor is more difficult to accurately trace, as correct medical histories are not commonly fully appreciated by the average ward patient.

In Williamson's series of cases from the Cook County Hospital, Chicago, only thirteen per cent. of one hundred and sixteen cases gave a history of parental gout.

It has long been noted that, although the women of gouty ancestry may escape typical gouty manifestations, they are more likely to transmit the disease than are the men. The disease is frequently transmitted from grandparents to grandchildren without the fathers or mothers ever having suffered from classical gout. A study of the influence of heredity in this disease would tend to the belief that if the inherited tendency is sufficiently marked an individual may develop gout no matter how self-denying a life he may lead. On the other hand, a less marked inheritance may lie dormant until such time as the combination of other influences act as determining factors.

Alcohol. Next to hereditary influences alcohol would head the list in importance among the predisposing causes.

Beer, ale and porter with port and sherry wine have the deserved reputation of being much more "gout producing" than are the distilled liquors such as whisky, brandy, rum and gin.

It has been many times pointed out that in Scotland, where whisky is the favorite drink, gout is much less often met with than in Southern England and certain sections of Germany where beer is the chief beverage. Fitcher considers that beer is the chief etiological factor in the production of gout in the United States and lists "heredity" as secondary in importance to it.

It will be interesting to note whether the attempted elimination by law of alcohol as a beverage will decrease the amount of gout in years to come.

Excessive Amount of Food and Deficient Amount of Exercise. All authorities agree that gout is frequently the penalty of high living in the individual with a tendency to metabolic deficiency. Too much rich highly nitrogenous food has always been accused of rendering an individual liable to gout.

Too much food and too little systematic exercise are certainly two most important factors in the development of gout, especially when those factors are reinforced by the influence of heredity and the action of alcohol. Pratt states that the increase of gout in Germany during the twenty years that preceded the world war was due to the fact that increasing prosperity had allowed the people to indulge in a much greater consumption of meat than they had formerly been accustomed to.

Age. Gout is truly a "disease of middle life," that is, its onset usually dates from the thirtieth to the fortieth year. Exceptions to this general rule, however, are met with in both youthful and aged patients.

In Scudamore's study of 515 cases he mentions four cases as having occurred before the age of 17, while in James Lindsay's series of four hundred and eighty-two cases, one instance was in a boy of 9; four between the ages of 10 and 14, and thirteen between 15 and 19 years of age. Three cases were observed in Fitcher's series of ninety-two cases whose ages were from seventy-one to eighty years, and Garrod reports several instances where gout made its appearance after the patient had lived in health for seventy-five years, he mentions one who had her first attack in her ninety-first year.

The statement has been frequently made that most of the cases of gout reported as having occurred in childhood and in extreme old age are errors in diagnosis. This general statement may be true and still the writer has seen gouty tophi (proved by microscopical examination of the contents) in a boy of 12 and another of 14 years of age and treated a man of 91 in his first and only attack of gout, which was followed two months later by the appearance of a typical gouty tophus in the ear.

Sex. There is a marked contrast in the susceptibility of the sexes. Males are much more liable to the disease than females. Of the eighty cases submitted to the French Academy, seventy-eight were men and only two women. In James Lindsay's series of five hundred and sixty-nine cases, 84.7 per cent. were males and 15.3 per cent. females.

If we judge the presence of gout by the only pathognomonic diagnostic criterion, *i.e.*, tophi, gout in women is ex-

tremely rare but if we are tempted to interpret as gout atypical cases of arthritis in the over-nourished and under-exercised women of the leisure class, then the diagnosis will be much more frequently made than proved.

It is to be remembered that a female patient suffering from an arthritis should be as closely scrutinized for the evidences of gout as a male, for women, as a class, are taking less systematic exercise during the middle years of their life than they should while they continue to consume more food and, as a rule, richer food than is good for them.

Sedentary occupations and sedentary living especially when associated with lack of systematic exercise and over-indulgence in food and alcohol is a factor of great importance in the production of gout in either sex.

Lead. Futcher quotes Musgrave, Huxham and Falconer as having drawn attention to the relationship existing between lead poisoning and gout as long ago as 1772 and Parry, in 1807, again directed the attention of the profession to this intimate relationship. Sir Alfred Garrod (1854) awakened new interest in the subject by reporting that one-fourth of all his patients that suffered with gout had at some time been affected with lead poisoning. He called attention to how many of the gouty patients had been employed as plumbers and painters. Sir Dyce Duckworth noted that twenty-five of one hundred and thirty-six typical cases of gout showed signs of lead poisoning and recently James Lindsay has reported that out of a total of four hundred and eighty-two instances of males afflicted with gout that one hundred and eight or 22.4 per cent. were workers in lead.

In Futcher's series of sixty-three cases of gout only three showed definite signs of lead poisoning.

Pratt states, however, that among a large series of cases of chronic lead poisoning studied at the Massachusetts General Hospital there was not a single case of gout and Frerichs had the same experience in a study of one hundred and sixty-three cases of plumbism in the Berlin Hospital (Duckworth).

A few days since there was admitted to the wards of Dr. H. A. Hare at the Jefferson Medical College Hospital a well nourished man, aged 52, who gave a characteristic history of repeated attacks of articular gout. This man had been exposed to the

fumes of lead for eighteen years. He had typical gouty tophi (proved by microscopic examination). The tophi were soft and appeared so pultacious that it had been suggested that they might prove to be sebaceous cysts.

We do not know how lead acts to bring about a predisposition to gout, but Garrod made the suggestion that as so many cases of lead poisoning develop an albuminuria and later a nephritis, and as so large a number of these cases also reveal an abnormal amount of uric acid in the blood, that the latter condition was probably due to a renal insufficiency. Sir Dyce Duckworth held the opinion that lead acted injuriously upon the nervous centers and thus caused gout.

The former view appears the more tenable.

Occupation and Physique. Painters, plumbers, enamelers and those who are exposed to the fumes of lead are likely to be attacked although it must be remembered that it usually takes a long period of exposure to bring about the conditions necessary to cause gout.

In very susceptible individuals very mild exposure to lead has been known to precipitate an attack of gout. Sir Lauder Brinton has reported a patient who, following the ingestion of a small amount of lead in the form of lead and opium pills, developed a typical attack of gout although he had never previously been so afflicted. Llewellyn reports a similar but more striking instance in which a woman not known to be gouty used a hair lotion containing lead and who in a few days developed arthritic gout. The drinking of water impregnated with lead by being allowed to stand in pipes of this composition has apparently precipitated gout in the susceptible. Bartenders and those who work in breweries, owing to the free use of malt liquors are prone to become gouty.

Persons who have a large frame with a tendency to obesity are usually the type likely to manifest gout.

Traumatism. Authorities differ regarding the importance of the rôle of trauma as a predisposing factor in the production of gout. Certain observers feel that coincidence explains the onset of an attack of gout after an injury to a joint. The majority of authorities upon the subject, however, and all the experienced gouty patients feel sure that injury to a

joint renders the part very much more susceptible to an attack of gout.

The disease has been often observed for the first time following an injury to the joint, and equally often a gouty individual has noted that following an injury to a joint never before affected with gout an attack in this particular joint is apparently precipitated by the trauma.

Sprains, fractures, dislocations and even slight injuries often precipitate an attack of gout in the susceptible.

Lindsay reports nineteen cases in which trauma appeared to be the active and definite predisposing factor in precipitating an attack of gout.

Dr. Thomas Kain of Camden reported to me an instance in a patient who fractured his femur and who developed a few days later a typical attack of acute gout in the big toe of the affected limb. This was followed in ten days by the appearance of gouty tophi in the ear. The patient had never before had an attack of gout and was accustomed to live a very active life.

EXCITING CAUSE.

The exact cause of gout is unknown. The modern view of the etiology is expressed in the definition of the disease, "a constitutional disorder, frequently inherited, due to faulty metabolism and functional inferiority of the kidneys, in which the amount of uric acid and other purin bodies in the blood and tissue fluids is increased and in which deposition of uratic salts in certain tissues takes place."

To possess a complete understanding of the biochemical problems involved in a study of the metabolism of the purin bodies would necessitate the highly specialized education and training of the modern biochemist. It is sufficient, however, for the purposes of the general practitioner of medicine to enable him to make himself familiar with the essential facts concerning the chemistry of the purin bodies, for in a study of the metabolism of these bodies one approaches the truth concerning the etiology, pathology, symptomatology and treatment of gout. The older physiologists believed that protein in the food was rendered soluble by the digestive enzymes and then absorbed into the blood and at once incorporated into the tissues. The modern study of protein

metabolism indicates that protein cannot be absorbed as such from the alimentary canal, but must first be broken down into the amino-acids, which are then rebuilt into the protein of the organism.

The amino-acids not required for the purpose of reconstruction of the broken down protein of the body, along with those that may be liberated in the tissues themselves by disintegration of tissue proteins, are then split into two portions, one represented by ammonia and the other by the remainder of the amino-acid molecule. The former is excreted as urea and the latter is oxidized to produce energy (Macleod).

By an examination of the chemical formulas of the purines we note that the basic substance from which the others are derived is purin.

The list is as follows:

Purin, $C_5H_4N_4$.

Hypoxanthin, $C_5H_4N_4O$.

Adenin, $C_5H_3N_4O_2$.

Xanthin, $C_5H_4N_4O_2$.

Guanin, $C_5H_3N_4ONH_2$.

Uric acid, $C_5H_4N_4O_3$.

It will be noted that the highest oxidation product of all is the urinary constituent, uric acid, which may be designated as trioxypurin. These purin bodies result from the action of certain specific ferments or enzymes, upon the nucleoproteins of the food and of the tissues. Uric acid is thus formed both from the body tissues and from the proteins of the food.

When uric acid is once formed in an individual with inherited tendency to gout, there is difficulty in ridding the body of it. This inability to oxidize or excrete the excess of uric acid formed appears to be the important factor in the production of gout. Biologists inform us that, "all mammals, with the important exception of man, are able to destroy uric acid rapidly and in considerable quantities. This destruction is an oxidation brought about by a specific enzyme called uricase, and the reaction seems to consist of the removal of one of the carbon atoms from the uric acid, thus converting it into the more readily soluble allantoin" (Wells; quoted by Osler and McCrae).

Llewellyn states that the enzymes responsible for the disruption of the nucleic acid complex are not to be found in all the body tissues. The liver, spleen, thymus, and pancreas, more particularly, contain enzymes in abundance. The enzyme responsible for the oxidation of xanthin into uric acid, *vis.*, xanthin-oxidase, is found in man only in the liver.

In man, as in most mammals, uric acid is formed chiefly in the liver from purins. Nucleic acid is a chemical complex, made up of phosphoric acid with purin bases. The nuclein element of the food requires the enzymes of the pancreatic secretion to break it up into nucleic acid and protein. The nucleic acid undergoes partial decomposition after it is acted upon by the intestinal juices through the action of a ferment called nuclease. Under its influence the nucleic acids are further split into groups known as nucleotides. Through the action of another enzyme, nucleotidase, the purin nucleotides are further decomposed into nucleosides. The nucleosides are again acted upon by the enzymes of the spleen, liver and thymus (nucleosidases), and broken down into the so-called "building stones" of the nucleic acid molecule, phosphoric acid group, carbohydrate group, pyrimidin and purin bases, especially adenin and guanin. The adenin and guanin thus formed are, by the action of the ferments adenase and guanase, converted and by the removal of their amino group, transformed (adenin into hypoxanthin, and guanin into xanthin). By the action of oxidases in the tissues hypoxanthin is changed into xanthin, and xanthin into uric acid, this by a specific ferment xanthin oxidase.

Summary Concerning Metabolism. We have learned that in man, uric acid is the end product of protein metabolism. It is derived from nucleins and formed chiefly in the liver. Loss of the power of elimination favors the deposition of uric acid products. Those individuals who cannot rid themselves easily of their purins, endogenous or exogenous, may be said to be gouty. Certain persons inherit this tendency to defective elimination of uric acid products, and certain others acquire it by their mode of life.

In typical cases of gout the amount of uric acid in the blood is increased from the normal quantity of one to three millegrams per cent. to several times that amount. This

appears to indicate the inability of the kidney to rid itself of this product. The true cause of the deposits of uratic salts must be some change in the chemistry of the blood that alters the form of uric acid there contained and thus brings about a deposit of its salts.

It is to be remembered that uric acid is found in excessive amounts in certain other disorders, such as leukemia and chronic nephritis, and it is equally true that in the interval between acute attacks of gout there may be marked increase in the amount of uric acid in the blood without there being symptoms of gout present.

The proved fact that uric acid can be injected into the blood-stream in considerable quantities without causing symptoms of gout, does not indicate that there is no danger to susceptible individuals who are unable to rid themselves of the excess of uric acid in their blood.

PATHOLOGY.

The Blood in Gout. The amount of uric acid is definitely increased. Garrod was the first to point out the quantitative increase, in 1848. By his introduction of the "uric acid thread experiment," better known as the "thread test," Garrod stimulated an active interest in the disease by the new light that he had been able to throw upon the pathology of the disorder.

Garrod described the "thread test" as follows: "Take one or two fluidrams of the serum of blood, and put it into a flattened glass dish; to this add ordinary strong acetic acid, in the proportion of six minims to each dram of serum. When the fluids are well mixed, introduce one or two linen threads, about an inch in length. The glass should then be set aside in a cool place until the serum is quite set and almost dry. Should uric acid be present in quantities it will crystallize and during its crystallization will be attracted to the thread, and assume forms not unlike that presented by sugar candy upon a string. The glass, with its threads, should be placed under the low power magnification and the crystals of uric acid easily seen."

The thread test has been replaced by more modern tests but it is still useful for demonstration.

Roethlisberger, Folin, and Denis, and Stanley Benedict, have introduced simple and accurate tests for uric acid in the blood which are available to all. Benedict's latest test will probably supersede all other tests as it is simple, accurate and easily performed. The fact that extreme accuracy is possible, even when only one or two cubic centimeters of blood serum is used for testing, will recommend it.

The importance of the work of Folin and Benedict in perfecting the tests for uric acid in the blood cannot be exaggerated. Previous to Folin's work no method existed by which the amount of uric acid could, even approximately, be determined.

Adler and Ragle tested the blood of one hundred and fifty-six non-gouty patients and found that the average amount of uric acid was 1.7 milligramms per 100 cubic centimeters of blood. In Pratt's study of twenty-one gouty patients there was an average amount of 3.7 milligramms per 100 cubic centimeters of blood. The same observer noted that in a few cases of undoubted gout the uric acid content was within normal limits, though it never fell, even on a purin-free diet, below 1.4 milligramms. Pratt feels that the low values in certain of his cases may have been due in part to the errors inherent in the original Folin method.

In a later study by McClure and Pratt of forty-nine cases of gout in which the uric acid in the blood was estimated by the original method of Folin, thirty-eight (or eighty-six per cent.) showed 3.1 to 7.2 milligramms per 100 cubic centimeters, and six from 1.7 to 2.8 milligramms.

Macleod mentions four cases in which the figures were 9.5, 8.4, 7.2, and 6.8, respectively.

Although the high uric acid content is a feature of the majority of the cases of gout and the content is usually higher during an attack than in the intervals, Pratt's observations indicate that both in gouty and non-gouty subjects fluctuations in the uric acid content occur quite independently of diet. Pratt states that a characteristic of gout is the presence of three or more milligramms of uric acid with the non-protein nitrogen amounting to less than fifty milligramms.

Authorities agree that leucocytosis is the rule in an attack of acute gout and it is usually stated that there is a very marked degree present (20,000 to 50,000). Even in a sub-acute gouty polyarthritis high counts are frequently reported and in the chronic forms it is common to find a moderate leucocytosis.

Chalmers Watson reported the presence of a large number of myelocyte-like cells during an attack of acute gout, and Bain confirmed his finding in one of his cases but states that the peculiar cells were present in small numbers in his case.

DaCosta and Ewing have reported instances of moderate leucocytosis in both the acute and chronic forms of gout.

In the chronic forms of the disease a mild anemia is frequently observed but whether this is due to the frequent association of a nephritis or to the metabolic disease is not definitely known. It is reasonable to believe, however, that the loss of sleep, the pain and general distress might easily bring about an anemia, and these causes in addition to the marked tendency to arteriosclerosis and kidney pathology, might easily explain the anemia without ascribing it to podagra.

Tophi. A gouty tophus is a local deposit of uratic salts. Such deposits are usually found in connection with cartilages, especially the cartilages of the ear, tendons, synovial membranes, muscles, and the skin, but are also frequently found in the vicinity of the joints and bursæ, especially over that of the olecranon and patella.

According to the statistics of Duckworth, in one-third of all well marked cases of gout, tophi are to be found in the helix, antihelix, fossæ, and in the lobule of the ear, and, in rare cases, also upon the posterior surface of the pinna. It is to be noted that in many cases where gouty deposits exist in the joints, there may be an entire absence of tophi in the ears and other superficial parts.

Tophi were recognized very early in the history of gout, and Aretæus, writing in the second century, A.D., made the following observations: "Callosities also form near the joints; at first they resemble abscesses, but afterward they get more condensed, and the humor being condensed is difficult to dissolve; at last they are converted into hard white tophi and over the whole there are small white tumors like

vari or larger, but the humor is thick and like hailstones." The view that tophi were made up of chalk existed for centuries and it was not until the researches of Wollaston (1797) that tophi were found to be very largely made up of sodium urate. It is well known that tophi occasionally become calcified, but repeated examinations by modern chemists have shown that the chief constituent of all true tophi is sodium biurate.

We know that in the blood and lymph of an individual suffering from gout there is an excess of uric acid, either existing in the free state or in combination. In uratosis we have a precipitation of the uric acid salts and a collection of these salts in certain structures.

We do not yet know the exact nature of the chemical change that brings about a precipitation of the salts of uric acid in the blood. Why a patient may carry an excess of uric acid in his blood for months and years without uratosis, and why he suddenly develops the latter, is as yet a medical mystery. The biochemists inform us that uratosis cannot exist without excess of uric acid in the blood.

The exact composition of the nucleus about which the urate of soda is deposited is unknown, but as concretions in the body frequently form about masses of mucin, bacteria and precipitated proteins, it is quite possible that this combination may form the nucleus of a tophus. As the acicular crystals are deposited they become covered with mucin, animal, or earthy matter. The tophus is thus formed of crystalloids and colloids, both evolved from the fluids of the body. Chemists state that the conditions that control the solubilities of crystalloids and colloids are most complex, and although these conditions do not entirely explain the nature of gout, the variations doubtless stand in intimate relation to the formation of tophi. Authorities seem agreed that tophi are always preceded by local inflammatory reaction of varying degrees of severity, and that uratic deposits are a sequel to the inflammatory change. It is this tendency in gout to uratosis, *i.e.*, the deposit of sodium urate, that frequently renders the diagnosis of even an obscure condition easy. We know that uratosis is confined to one disease—gout—constituting its pathognomonic stigma. Osler

pointed out how helpful the presence of tophi were in a differential diagnosis of any form of polyarthritis. He advised a careful inspection of the ears, the tendons, and the region of the smaller joints, for tophi in all obscure arthritic conditions. Negative findings may be of almost as much value as positive findings in certain complicated joint disorders.

It is well to bear in mind that when a tophus first makes its appearance it is, not infrequently, immature, soft, and abscess-like. It begins as a small red area on the auricle of the ear or elsewhere, and is all too frequently overlooked or misinterpreted.

It has been pointed out that it is well to remember the possibility of the disease being gout when dealing with obscure maladies, especially in those connected with an arthritis. The following symptoms and physical signs have been helpful:

(1) Pain, pricking sensations, heat or tenderness in the ears, with or without small red swellings of the skin.

(2) Similar sensations at site of finger and toe joints, with dorsal swellings over which the skin may be reddened or unchanged in color.

(3) The existence of white pearly concretions, sometimes soft, *i.e.*, mature and immature tophi.

In dealing with both the mature and immature tophi it is usually easy to determine the true nature of the swelling. In the immature (soft) swellings a portion of the semiliquid contents can frequently be withdrawn by aid of a hypodermic syringe and needle, for examination. If a mature tophus, its contents can be removed by a surgical needle and examined with the microscope. Many observers have noted that when tophi first appear, sensations of stinging pain and tenderness accompany them. The patient often finds the pain unbearable when his ears (containing beginning tophi) rest upon the pillow. Graves, of Dublin, a victim of gout, reports that in his own case this burning pain and tenderness of the ears was most distressing and only disappeared when the gout invaded his finger joints.

It is in the chronic form of articular gout that tophi are most likely to occur, but it is also true, as Duckworth and

other observers have shown, that tophi sometimes precede by several years the arthritic form of gout. Trousseau states that small and often immature tophi or "cutaneous gravel" may constitute the only manifestation of the gouty diathesis, and is often accompanied by a sensation of pain or prickling unattended by any disturbance of the general health.

Tophi are frequently met with over the tendon sheaths, and especially over the olecranon and patella. These subcutaneous tophi in the neighborhood of the joints sometimes become tense and painful, and restrict the movements of the adjacent articulations. Tophi are found invading the integument of the limbs at times. They are not infrequently seen over the ulna and tibia. Pye Smith saw a man with ulcers upon his thigh and legs which ulcers were discharging sodii biurate.

Tophi are to be found in severe cases in the palms of the hands, the soles of the feet, pulp of the fingers, over the knuckles and the phalanges. They have been found in the eyelids, in the skin of the nose and cheek, and more rarely in the skin of the penis and scrotum, in the perineum and in the scapular region. Even in the conjunctivæ and scleræ tophaceous deposits have been rarely seen and recognized.

Uratric deposits may be of a considerable size and are frequently misinterpreted because of this fact. Llewellyn reports having seen deposits that were as large as a small hen's egg. The largest tophi are usually found near a joint, frequently in the upper extremity.

Even when large they are frequently non-adherent, the skin moving freely over the surface. Sometimes the presence of the tophus induces irritation of the overlying skin, which becomes reddened, then purple, and not infrequently the skin becomes ulcerated from pressure. Such ulcers often discharge large amounts of sodium urate, which gives the patient great relief.

Gouty inflammation never ends in suppuration, yet abscess formation very commonly occurs in the tissues about a gouty tophus. Garrod saw a patient that had five gouty abscesses on each hand and others on his feet. He writes that as long as the uratic deposit was discharged the patient

enjoyed immunity from gouty symptoms, but when healing occurred it was often the cause of a sharp attack. Uratic deposits within a joint are, of course, invisible, but they can sometimes be recognized by a grating sensation and noise when the joint is used.

The Kidneys. Many observers having had much experience with patients suffering from gout feel that an inflammation of the kidney is an integral part of the disease. Certainly the presence of nephritis is extremely common and an investigation of the kidney function in the presence of gout is most important. Ebstein describes two types of gout cases: (1) the "primary renal gout," and (2) the "primary articular gout."

Certainly a condition that might be termed "primary renal gout" is not a rarity. Fitcher reports such an instance from the wards of the Johns Hopkins Hospital, in a colored man of twenty-four years of age. For several months he had complained of the usual symptoms of chronic nephritis. There had been no previous arthritic history. A few days before his death, he developed pain and swelling of his right great toe-joint. The joint, at autopsy, revealed the characteristic deposits of sodium biurate in the articular cartilage. The kidneys were much contracted.

A very similar case was admitted to the wards of the Jefferson Medical Hospital, under the care of Dr. Thomas McCrae a number of years ago. The patient was a young white man of seventeen years of age, who came to the medical dispensary complaining of dyspnea. He was found to have a greatly enlarged heart and was sent to the ward for observation. A few days after his admission he developed a typical attack of acute gout with the suppression of urine. At this time tophi appeared in the pinna of the ear, with considerable inflammatory swelling. The patient lived a number of weeks and was to all appearance a classical picture of chronic interstitial nephritis. The systolic blood-pressure was extremely high, approximating 300 during the acute seizure of gout. A microscopical examination of the tophus in this case revealed the typical acicular crystals of sodium biurate, and the autopsy revealed deposits of this same salt about the only affected joint.

The usual form of nephritis met with in gouty patients is that commonly spoken of as "contracted kidney." The clinical relation, however, between gout and chronic nephritis is not definitely known. Sir William Roberts observed: "It is quite common to see articular gout, even of a chronic and inveterate character, run its entire course without any accompanying signs of structural disease of the kidneys." It is everyday experience to care for patients with chronic contracted kidney who never develop gout, and in those gouty patients that develop nephritis late in life there are many etiological factors that appear more important, in many cases, than does gout. Mosenthal's two-hour test to discover the true renal function is proving far more important than chemical or microscopical examination of the urine.

In a small number of cases of gout coming to autopsy a deposit of urates is found chiefly in the region of the papillæ. Norman Moore found this state in twelve out of eighty cases.

The most important statement that can be made regarding the relation of gout to nephritis is that the same etiological factors that tend to produce gout also serve to cause renal changes that lead to nephritis. We must leave to the future the solution of the relationship of the two diseases and in the mean time carry on a propaganda of prophylaxis that will aid in lessening the morbidity rate of both disorders.

Cardiovascular Lesions. Arteriosclerosis is a common accompaniment to gout, but whether the patient acquired his vascular pathology independently of the metabolic disorder is a difficult matter to prove. The blood-pressure is usually high and the vessels appear stiff to the palpating finger. Although the symptoms may be entirely connected with the heart and circulation, it is necessary to study the kidney function with great care lest the true cause be overlooked.

Disturbed cardiac action is very frequent in "gouty" patients; palpitation, arrhythmia, and even syncopal attacks, are not uncommon, especially among patients who eat too rapidly as well as too heartily. Attacks of true angina do occur, but attacks that simulate angina are far more commonly met with. Faulty hygiene in eating often causes flatulence that not uncommonly causes functional heart difficulties. Hypertrophy of the left ventricle is frequently met

with and systolic murmurs at the apex are common. It makes little difference whether we look upon the arteriosclerosis as primary or as secondary to the gout or to the kidney pathology, the symptoms and physical signs are the same and the treatment not unlike.

The arch of the aorta is frequently involved in an arteriosclerotic process, and systolic murmurs over the base of the heart and in the vessels of the neck can frequently be heard. The orifices of the coronary vessels may be narrowed and the vessels themselves sclerosed. Myocarditis is a common complication, as one would expect, and fatty degeneration of the heart muscle occurs. It is difficult to ascribe to gout the terminal pericarditis that is encountered, because the renal pathology might easily account for its appearance. Phlebitis is a relatively common complication. It sometimes occurs as a complication in varicose veins of the legs, or it may occur in various portions of the body.

Respiratory System. Acute and chronic attacks of pharyngitis are proverbially frequent in the subjects of gout. Tonsillar inflammation, both acute and chronic in nature, occurs, and in certain rare cases deposits of biurate salts have been recovered from the follicles.

Laryngologists have reported similar gouty deposits about the vocal cords, and in the epiglottis and laryngeal cartilages. Gouty tracheitis, bronchitis and pleurisy is met with occasionally, and it is quite likely that it occurs more commonly than is suspected.

Emphysema is an extremely common complication of gout and is accompanied by the chronic bronchitis that causes so many of the "winter coughs" that torment the victims of the disease.

One characteristic that is possessed by the majority of the complications of gout is the intractable course of the disorder when treated as a local ailment. Unless one has the presence of tophi to aid one, or the equally enlightening repeated attacks of an arthritis limited to the great toe, the failure of a local manifestation (as noted above) to improve under treatment may well direct one's thoughts to the possibility of gout.

Eye Complications. Ophthalmologists ascribe to gout many conditions of the eye in which the proof of the relationship is difficult, if not impossible. That a correct diagnosis of gout is frequently made by an experienced oculist months or years before typical arthritic symptoms occur, or before the deposit of tophi, is well known. It is equally true that the term "gouty" is carelessly used to designate conditions that could with justice be termed "toxic" or even "idiopathic."

It is well known that an excess of uric acid in the blood can cause certain acute hyperemias of the conjunctivæ, often recurrent in nature, that may or may not be associated with arthritic difficulties. Certain forms of keratitis occur so commonly in patients whose heredity and general characteristics incline to class them as victims of a metabolic disorder, that the condition is often termed "gouty keratitis."

There is a class of too well nourished patients, particularly women, who suffer with episcleritis and episcleral nodes, that respond so well to the treatment usually instituted for gout, that many careful observers believe that this disease accounts for the local inflammation.

That gout can be the sole cause for a severe, recurring, iritis has been known for a long time. This condition usually attacks one eye at a time and affects chiefly the superficial layers of the iris (de Schweinitz). Such an inflammation may appear as the first symptom of gout, the arthritic difficulties appearing months or even years later. It is well known that glaucoma occurs frequently in gouty subjects, but the exact relationship between the two disorders is not fully understood. Gout is so constantly associated, in its later stages, with arteriosclerosis and renal changes that it is impossible to feel that gout alone causes the condition.

Cataract, too, is a frequent complication of gout. Opacities of the vitreous occur, hemorrhage into the same structure as well as into the retina, and all these conditions have been ascribed to gout. Orbital optic neuritis, paralysis of the ocular muscles, and imbalance of the same structures, have occurred so frequently during the course of chronic gout that the disease is always mentioned as a possible cause of the condition.

Nervous Manifestations. Headache, attacks of migraine, neuralgias, and other nerve pains, are a very common experience of gouty patients. These individuals frequently complain bitterly of itching feet at night, and of itching sensations about the joints that later show inflammatory changes.

Sciatica and lumbago have frequently been ascribed to gout, perhaps more commonly than careful study would warrant. That uric acid deposits can and do cause both of these disorders has been frequently proved at the autopsy table.

Functional nervous symptoms are so frequent in patients known to be gouty that such symptoms are looked upon as part of the usual symptomatology of true gout. A careful history elicited from many so-called neurotic individuals frequently reveals a classical hereditary gout. The presence of tophi, or the onset of a typical attack of acute gout, not infrequently causes a change of diagnosis from a functional nervous difficulty without known cause, to the same diagnosis with a well defined cause, *i.e.*, gout.

Urinary Disorders. Albuminuria is an almost constant finding. Casts, hyaline in type, are found in nearly all cases of chronic gout, while in many cases the urinary sediment is similar to that commonly encountered in a case of chronic nephritis.

The urine is, as a rule, abnormally acid, high colored and scanty during the acute attack. There is commonly a marked deposit of uric acid and uratic salts. Sugar is found intermittently—gouty glycosuria. This condition sometimes develops into a state of true diabetes. When this happens the dietary treatment seems more effectual than it is in many cases of uncomplicated diabetes mellitus.

Kidney, ureteral and bladder stones are not uncommon complicating factors.

Urethritis, with a profuse, purulent discharge, has been reported a number of times in connection with acute gout. It usually appears at the end of the attack, without any other etiological factor than, possibly, a gouty tonsillitis being discoverable.

SYMPTOMS.

Gout is usually divided into the *acute*, *chronic* and *irregular* forms of the disease.

Acute Gout. Premonitory symptoms are the rule, although they are not infrequently ignored or misinterpreted. Uncomfortable sensations are commonly experienced for days and sometimes for weeks before an attack. Distaste for food, indigestion, oppression and fullness after eating, with eructations, tympanites, and constipation, are frequent symptoms. Twinges of pain in one or several joints, a feeling of heat and itchiness in a foot, slight swelling of a joint that causes a sense of stiffness, are frequently complained of.

Irritability of temper, restlessness, especially at night, burning sensation in an ear, or in both ears, and general bodily discomfort, are frequent.

A pharyngitis, coryza, a tonsillitis, a tracheobronchitis with troublesome, unproductive cough, frequently initiates the attack. The acute seizure usually begins in the early morning hours with a sudden agonizing pain in the great toe, more commonly in the right foot than in the left. At the same time the patient has a frank chill or a sense of chilliness. There is fever and the temperature may rise to 103° F. The pain is said by those who have experienced it to be more agonizing than mere words can describe, and Sydenham, himself a martyr to the disease, says: "The pain insinuates itself with the most exquisite cruelty among the numerous small bones of the tarsus and metatarsus, in the ligaments of which it is lurking."

The joint or joints swell rapidly and become hot, tense and shining in appearance. The local sensitiveness is extreme and the pain almost intolerable. There is often a local engorgement of veins about the affected joint or joints, and this engorgement becomes more marked as the attack progresses. Edema in the region of the joint is common, and in the sthenic attacks there have been reported ecchymoses.

With the subsidence of the attack the redness, edema and venous turgescence gradually disappear, and desquamation with itching occurs. Not infrequently there is more than one joint involved, particularly the tarsal joints. The in-

flammation, no matter how intense, never suppurates, and with the decrease of the swelling the joint returns to normal.

The tongue is usually coated during the attack, the breath foul, and the patient suffers with anorexia and intense thirst. The dyspeptic symptoms of the premonitory period often persist and are at times exaggerated. On the other hand, the digestive symptoms may disappear with the onset of the attack.

The urine is diminished in amount, high colored, extremely acid, and often reveals the presence of albumin.

As a rule the temperature abates during the morning hours and often reaches normal, or nearly so, but in the evening it rises to a higher level, with a morning remission as before, and so continues for a varying number of days, usually two to eight. The temperature then subsides and is often sub-normal for a number of days. There is usually a moderate leucocytosis during the acute seizure, and occasionally an unusual high count without known complications.

After an attack of acute gout the general health is frequently much improved. Recurrences, however, are frequent, and a patient may have several attacks in a short period or, on the other hand, may be free of symptoms for months and even for years following a severe attack.

It should be remembered that following an attack of acute gout the formation of tophi often occurs. Trousseau pointed out that the tophus was evolved between attacks rather than during the attack.

Chronic Gout. It is difficult to sharply differentiate chronic from repeated attacks of acute gout. A long interval may elapse between the early manifestations of the disorder, and in many instances a period of from many months to several years intervene between the first and second seizures. After two or more attacks later paroxysms occur, usually, at more frequent periods. The dividing line between acute and chronic gout is very indefinite and is regarded as an arbitrary matter. Flint stated that, "if the disease continues beyond three or four weeks, it is to be considered as chronic," while Trousseau stated that, "should the disorder extend beyond three months, it is chronic gout."

The predilection of the disease for the great toe-joint continues into the chronic form. In a progressive case, joint after joint is involved, the tarsal joints, wrists, knees, and elbows being most frequently affected. Garrod held the sequence to be as follows: the great toe, heels, ankles, knees, small joints of the hands, shoulders, and hips.

Lindsay states that in a total of four hundred and eighty-two cases in males, the great toe was the initial point of attack in two hundred and forty-eight cases, or 51.3 per cent. In females the great toe is not so frequently affected. Thus, in a total of eighty-seven cases the onset began in the great toe in twenty-two cases, or 25.3 per cent.

A striking feature is the frequency with which the joints of the lower extremities are first invaded in comparison with those of the upper extremities. Thus, in Lindsay's series of four hundred and eighty-two males, the joints of the lower limbs were those first affected in four hundred and six, or 84.2 per cent. Norman Moore states that the gouty deposits may affect all the joints of the lower limbs and be entirely absent from those of the upper limbs.

Sometimes one attack seems to merge into the next, but the latter seizures are rarely as severe in character as are the earlier experiences. The joints become more or less deformed, and tophi may develop about the joints as well as in other portions of the body. There is much difference in patients regarding the amount of deformity that results. Certain patients are badly deformed by one attack, while in other patients there may be no noticeable change in the joints after many and apparently severe attacks of the disorder.

In severe forms the hands and feet may be much deformed, and there may be extensive concretions about the elbows and knees, in the bursæ and along the tendons.

Tophaceous deposits occur almost exclusively in connective tissues, especially those in connection with the joints. As a rule, the deposit is first made in the synovial membranes, articular cartilages and other tissues within the joint cavity. Later on in the history of the disorder deposits may occur in the tendon sheaths, synovial bursæ, fasciæ, and certain subcutaneous tissues. In the course of years the frequently

affected joints become swollen and deformed, and there may be extensive concretions about the elbows and knees and along the tendons and in the bursæ.

The successive attacks of painful swelling, with the consequent loss of sleep and digestive disturbances, often seriously affect the patient's general health. The complicating arteriosclerosis and renal changes produce symptoms commonly associated with such disorders. Intercurrent attacks of acute arthritis frequently occur, and the temperature may range from 100° to 103° F. On the other hand, there may be redness, pain and swelling in a number of the joints without fever.

Irregular Gout. This term is commonly used in describing a group of ill defined symptoms that occur in certain patients suffering from nutritional disorders in which there is, for one reason or another, a suspicion that the symptoms are "gouty."

It is well known that a strong temptation exists to think of "gout" in dealing with the symptoms of members of a family in which there may be a typical example of acute or chronic gout associated with tophi. Such symptoms are often encountered in the class of patients who live sedentary lives and who eat and drink too heartily. Functional liver disturbances, indigestion, headache, neuralgias, eye symptoms not explained by refractive errors, irritability and vague symptoms of unrest, are the common symptoms ascribed to irregular forms of gout.

Certain of the patients who exhibit such symptoms do later in life develop typical gout, while others with equally disturbing family histories and suspicious symptoms fail to do so.

There is little doubt but that a diagnosis of "irregular gout" opens a wide field for mistaken diagnosis, but it is equally true that one is forced to such unsatisfactory diagnoses at times and the developments of time apparently justifies the use of the term.

Retrocedent Gout. The term "suppressed" or "retrocedent" gout has been applied for many centuries to serious symptoms that occur coincidentally with a more or less rapid disappearance of the local arthritic inflammation. There can

be little doubt that many of the reputed instances of this nature were incorrect diagnoses.

Symptoms of tabes, angina pectoris, coronary thrombosis, biliary colic, appendicitis, renal stone, uremia, pericarditis, cerebral apoplexy, and many other conditions, could easily be mistaken for the mysterious entity that has been characterized as "metastatic gout."

Very remarkable manifestations have undoubtedly occurred following the rapid disappearance of or improvement in the local inflammatory symptoms and signs. What the true explanation of these symptoms—acute pain, vomiting, diarrhea and great depression in one class of dyspnea, pain, and irregular heart action or possibly delirium or coma in another—is, is not easily ascertained.

Llewellyn quotes Dr. Parry, of Bath, as having witnessed in one winter two instances of apoplexy following "the removal of gout in the extremities by immersing the feet affected in cold water." Llewellyn states that in certain individuals under his care who attempted the same revulsive procedures, severe cardiac pain has ensued with syncopal attacks, sometimes fatal, while in others gastrointestinal attacks of great severity have developed.

When we remember the state of the circulation and the altered kidney function in many of these patients who suffer with gout, one can see that coincidence may explain many puzzling factors in these medical emergencies. One does well to follow the advice of Sydenham, "to study the patient instead of the gout."

DIAGNOSIS.

In the majority of cases of acute gout no great difficulty should arise. An arthritis, limited to the great toe or to the metatarsophalangeal and tarsal joints, is very characteristic.

The extreme grade of inflammation, the shiny appearance of the skin and the agonizing pain is very characteristic. If the affected individual has a gouty heredity and lives the kind of life that encourages metabolic disturbances, the diagnosis of gout is all the more plausible. There are many cases of this malady, however, who will have arthritic disturbances elsewhere than in the feet, and only a carefully elicited history will reveal that years previously there had been an

involvement of the great toe. It is commonly observed that after one or more attacks of the disease limited to the metatarsophalangeal joints, other articular surfaces may be affected at a much later period when the memory of the original involvement has been dimmed by time. An arthritis of the hip, knee or shoulder due to gout is sometimes misinterpreted as due to a focal infection, to lues or to rheumatoid arthritis.

The presence of tophi are most helpful in arriving at a correct diagnosis when such deposits are present. Osler felt that a careful search for tophi should be made in every case of arthritis. Although the tophi are commonest in the cartilaginous portions of the ear, in the vicinity of the helix and antihelix, they are frequently found in other situations as mentioned under the section describing them.

Tophi should not be confused with sebaceous cysts nor with the small fibroid nodules sometimes observed on the margin of the ear. An examination of the contents of a tophus with the microscope obviates any possibility of error. Where there are large deposits about the knee, elbow, toe or finger, the diagnosis is manifest.

Futcher has pointed out that subcutaneous tophi, clinically indistinguishable from fibroid rheumatic nodules, may occur over the extensor surfaces of the forearms and about the knees. The excision of such a nodule and microscopic examination of its contents will reveal the characteristic crystals.

A feature of diagnostic importance is the low range of temperature seen in acute gout when compared with the temperature range of acute rheumatic fever. Numerous reliable observers have reported cases of acute gout that were afebrile. Any polyarthritis with acute manifestations and unaccompanied by fever, should always cause a strong suspicion that it is gouty in origin (Futcher).

The family history, the personal history as to occupation, habits, exposure to lead poisoning, the history of the onset of any arthritic disorder, are all most important in attempting to diagnose an obscure condition. The x-ray may be of some assistance in differential diagnosis but other arthritic disorders simulate the shadows of gouty manifestations to

such an extent that the photograph is, frequently, of less importance in deciding the matter than is the history of the attack. The x-rays frequently fail to reveal the existence of a deposition of urates in the articular cartilages. When an attack of acute rheumatic fever subsides there is no deformity or limitation of functional activity observed. When we deal with an acute arthritis that does leave as a sequel a deformity or some limitation of motion as a sequel, we may assure ourselves that we are dealing with gout or with rheumatoid arthritis.

In arthritis deformans the well known ulnar deflection of the fingers takes place, as well as the almost constant occurrence of atrophy of the dorsal interossei muscles of the hands.

Heberden's nodes, the exostoses on the terminal phalanges in arthritis deformans, have been known very rarely to occur in true gout but their appearance points, as a rule, to arthritis deformans.

It has often been pointed out that when arthritis deformans affects the larger joints, such as the knee, wrist, or elbow, the deformity is more likely to be fusiform in shape.

When arteriosclerosis and renal involvement complicate a chronic arthritis it is well to search for evidences of gout. The fact that we do not think of gout in connection with obscure arthritic disorders often accounts for our failure to correctly diagnose it.

The estimation of the amount of uric acid in the blood by the latest Benedict test will, in the future, prove a helpful agent in differential diagnosis when considered in conjunction with other and equally important facts. An estimation of the number of leucocytes is also helpful, as there is so consistently a leucocytosis in the acute manifestations of gout.

The Wassermann test, a search for Neisserean shreds in the urine, a prostatic examination, have all been known to reveal the exact nature of an obscure arthritis.

PROGNOSIS.

This depends more upon the complications that may occur than upon the treatment instituted.

The complications that may shorten life are those concerned with the circulatory organs and the kidneys.

The appearance of albumin in the urine is by no means to be taken as an indication that the patient has a serious nephritis. This symptom should be carefully studied, as albuminuria has been known to exist in a gouty patient for many years without the kidney function becoming seriously impaired.

Members of gouty families are frequently long lived and certainly their death is seldom due directly to gout.

The prognosis depends, in part, upon (1) the constitution of the patient; (2) upon the early and correct diagnosis; (3) prevention of complications; (4) intelligent direction and treatment of the patient.

TREATMENT.

The modern treatment of gout cannot be said to be entirely satisfactory. Like the treatment of many other chronic disorders, the results are satisfactory neither to the victim of the disease nor to the physician who attempts to relieve the patient and cure the disease.

The subject of the treatment can be appropriately divided into three parts:

- (1) Prophylaxis.
- (2) Treatment of the acute attack.
- (3) Treatment of chronic gout.

Prophylaxis. From what has been previously stated concerning the nature of gout and concerning the various etiological factors involved in the production of the malady, it must be evident that preventive measures are likely to be much more efficient in preventing the onset of the disease than are drugs or other therapeutic measures in curing it.

Ideal prophylaxis would naturally and correctly begin with a careful selection of a patient's ancestors, in order to insure that no tendency to metabolic disorders should be inherited. The selection of proper ancestors for our patients, however, is seldom practicable, even when such selection might be possible. There are prophylactic measures that are both practical and helpful. The prevention of gout, even in sus-

ceptible families, may be expected when physicians become particularly interested in metabolic disorders and when they take advantage of their opportunities for giving helpful instruction regarding personal hygiene to their patients.

Practical advice regarding diet, beverages, exercise, bathing, choice of occupation and sports, can be of the greatest value if based upon scientific data and sound reasoning.

There can be no doubt that individuals who have been unfortunate enough to have inherited a tendency to gout or who have exhibited evidences of the malady, should abstain from all alcoholic beverages, eat moderately of plain foods, and live active lives, if possible, in the open air. Dietary indiscretions, especially those of overeating and overdrinking of alcoholic beverages, in conjunction with lives of physical inactivity, lead straight toward gout and other metabolic disturbances. This is particularly true if there has been inherited a tendency to gout. Both ancient and modern authorities upon the subject of gout agree that open-air exercise, good hygienic surroundings, moderation in food consumed, complete avoidance of alcoholic beverages, and freedom from worries, are among the best prophylactic measures that can be employed. It is well to remember that gouty individuals are susceptible to other infections and the better hygiene that can be adopted the better chance the patient has of escaping various infections.

Particular attention should be directed to the care of the skin. Frequent bathing is particularly necessary in the gouty, and blanket baths, vapor or hot-air cabinet baths are distinctly helpful in selected cases. Care should be observed to prevent undue chilling of the body at any time and especially following the hot baths.

An occasional mercurial purge, followed by mild salines, is frequently helpful and possesses the impressive authority of long usage by the profession. Few prophylactic measures are based upon such scientific facts as the necessity for a decreased amount of food consumption in the average case of gout.

The somewhat trite but true statement that the average person, whether child or adult, eats too much, will not be questioned by any observing person. The truth of the state-

ment is proved in part by the evidence of one's eyes. For men, women and children are to be seen who are and who remain through life, much overweight.

The diet of a patient who, through heredity, is susceptible to gouty influences, should be a simple, easily digested, mixed diet. Alcohol, tea and coffee should be avoided. That the average individual drinks too little water is frequently pointed out by those who make a study of metabolism, and it is particularly well for persons predisposed to gout to drink water freely. There is little evidence that aerated and other expensive waters are superior to any pure water as an eliminant. Water cannot leave the body without carrying with it certain accumulations of waste products.

No one will venture to assert that the use of tobacco will prevent gout, while a number of authorities feel that this drug, even in so-called "moderate quantities," is a distinct source of danger as a predisposing cause in a subject susceptible to gout.

Exercise as a prophylactic measure is highly recommended by those who have an extended experience in the study of gout. The patient should be instructed to exercise or walk vigorously, unless there are complications that prevent such a course, daily.

Care should be taken to avoid chilling following such exercise, and usually a hot bath and vigorous rubbing add to the benefit of the exercise.

Sports in the open air, not too strenuous in nature, add the benefit of the interest elicited to the beneficial exercise in the open air, and should be enthusiastically encouraged in suitable cases. Gout is so invariably the result of over-nutrition and under-elimination that encouragement should be given all measures that tend to decrease the amount of food consumed and aid in the excretion of waste products.

Treatment of the Acute Attack. This consists of those measures that will relieve the patient's pain, reduce the swelling in the joint or joints, permit rest and sleep, and, if possible, prevent another attack of similar nature. Acute gout must be treated somewhat differently according to the age, constitution, and present vital powers, of the individual affected.

In this disease it is particularly necessary to bear in mind that it is the patient suffering from an attack of gout that is to be treated, and not the disease alone. It is the man or woman that we must have constantly in our minds, and a careful study of each individual patient must be made in order that one may be successful in treating the malady.

For the relief of the intense pain and associated sleeplessness, it is frequently necessary to administer morphin or other sedative drug by hypodermatic injection. To the writer, all the possible theoretical objections to this plan of procedure give way before the great and practical good accomplished by the administration of suitable doses of the drug. In this connection it is well to remember that sufficient drug should be administered to relieve the symptoms, even if large amounts are required. In mild attacks and when dealing with patients who are willing to endure a certain amount of distress, opiates may not be necessary, but in the presence of great pain and restlessness, morphin should be freely used. The patient should be confined to the bed, or at least should be recumbent for several days. The affected limb (or limbs) is nearly always made more comfortable if it is elevated slightly and kept warm by enveloping it in cotton wool or by frequently applying hot fomentations. In severe attacks it is always wise to protect the affected limb from the pressure of bed clothing and accidental pressure, by the use of a cradle or other protective measure.

All varieties of hot applications have been used and pronounced efficient by various patients which fact probably indicates that the virtue lies in the heat applied, rather than in the various medicaments incorporated in the various lotions. Applications of whisky and water as hot as could be endured was a favorite treatment in preprohibition days; lead water and laudanum, hot menthol solutions and other spirituous applications, are popular throughout the world.

The hot-air cabinet, the electric light bath, and other and more homely means of applying heat, such as poultices of various kinds, are very acceptable to many patients.

Two medicinal agents have proved most valuable in the treatment of the acute manifestations of the disease.

Tolysin (novatophan) is frequently most useful in relieving both the pain and inflammation of the joint or joints. This drug should be given freely early in the attack, in doses of fifteen grains, well diluted, every two hours until the pain is relieved or until it is evident that the drug is ineffectual in this particular case.

The wine of colchicum or the tincture of the same drug is known as a specific for gout and has been used for many generations. Given in doses of from one-half to one fluid dram every second hour until patient is relieved or until free purgation with gastrointestinal irritation ensues, the drug is frequently of great value.

Unfortunately, at times, each drug fails and it is necessary to try first one and then the other. Many physicians add a laxative to the use of either drug, although in the case of colchicum the added laxative is frequently unnecessary.

When both of the above mentioned drugs fail to improve the condition after a fair trial, the possibility of a mistaken diagnosis as well as the possibility of inert drugs must occur to us.

Textbook authority to the contrary, it is perfectly possible to mistake a septic arthritis, a luetic and even a Neisserean arthritis, for an acute attack of gout, and as can be readily surmised it is equally possible to mistake gout for one of the other forms of arthritis.

Instead of using the wine of colchicum many therapeutists use colchicina, U. S. P., in doses of $\frac{1}{100}$ to $\frac{1}{20}$ of a grain.

Most practitioners adopt the plan of giving a thorough mercurial purge followed by a saline before beginning the administration of any other drug. When opiates are not required to control pain and when insomnia is a troublesome feature of the attack, such drugs as chloral, luminal, barbitol, paraldehyde, or similar hypnotics, prove useful.

Chloral can be used with benefit in doses of from twenty to sixty grains, and is, in the experience of the writer, a harmless and most useful hypnotic. Paraldehyde is useful in a dose of from one to three fluid drams. Barbitol, in ten grain doses administered six hours before its effects are to be realized, has often proved effectual. Administration of one grain of luminal twice a day will sometimes make the patient

very comfortable and sometimes do away with the necessity for stronger remedies. Inert drugs are, unfortunately, not a rarity and one must be assured of potent preparations before condemning a remedy.

It is particularly important that one in whose care a gouty patient places himself should remember that because the patient has gout it does not follow that he may not have other and equally important maladies. When treatment appears to fail, an investigation should be made for complications.

Diet. The diet of a patient suffering an acute attack of gout depends, in great part, upon the age and general condition of the patient. The young, robust and plethoric individuals who have no complicating disorders, do excellently when deprived of all food for several days. During this period, water, carbonated or plain, should be given freely and the patient urged to drink large quantities of this diluent fluid. When the patient complains of hunger he may be given bouillon, consommé, vegetable, or chicken soup that is slightly salted and a moderate amount of toast. The quantity of food administered during an acute seizure of gout should be negligible and should preferably be administered in liquid form. After a few days, when the seizure is improving, a small quantity of fish and a small amount of thoroughly baked potato, with spinach, lettuce, celery, or other green vegetable, may be allowed.

The return to regular diet should be made gradually and with caution as to the amount of food allowed. A gouty patient will, if in otherwise excellent health, never receive too little nourishment, and the temptation of both physician and patient is to allow too much food.

In aged, asthenic gouty patients, or in those individuals who have complications, the light diet above described is frequently insufficient. One is surprised, nevertheless, to find how well starvation agrees with certain of the so-called asthenic patients.

Each gouty patient is particularly a law unto itself, but as Allen has so well and so profitably pointed out in dealing with another metabolic disorder, starvation can accomplish

so much more than we ever dared to hope for in former plans of treatment.

Plain, well-cooked foods should be allowed to asthenic patients who do badly rather than feel badly under the plan of a rigid withholding of food.

In advising a very gradual return by very slow stages to the usual diet, after an attack of acute gout, it is well for both physician and patient to remember that Sydenham, himself a great sufferer from gout, said: "Great eaters are liable to gout, and of these the costive more especially."

The patient should be advised to limit his diet as well as to vary the same as to varieties of food. Lettuce, spinach, asparagus, endive, beet and dandelion greens, celery, tomatoes, brussel sprouts, cauliflower, cabbage, and similar vegetables, whose carbohydrate content is low, can be eaten with impunity.

Bran biscuits, with or without the addition of agar-agar, are very useful in correcting the tendency to constipation that is so frequently a feature of gout and goutiness. Dr. F. M. Allen suggests the following recipe for the use of his diabetic patients:

Bran	60 grams (2 oz.)
Salt	$\frac{1}{4}$ teaspoonful
Agar-agar, powd.	6 grams $1\frac{1}{2}$ teaspoonfuls
Cold water	100 c.c. ($\frac{1}{2}$ glass)

The bran should be purchased at a feed store and should be the coarse bran that is used for feeding cattle.

Tie bran in a cheesecloth and wash under cold-water tap until water is clear. Bring agar-agar and water (one hundred cubic centimeters) to the boiling point. Add to washed bran the salt and agar-agar solution (hot). Mould into two cakes. Place in pan, on oiled paper, and allow to stand for half an hour: then, when firm and cool, bake in moderately hot oven thirty to forty minutes. When no glycosuria complicates the gout, the bran muffins can be made more palatable by adding butter and eggs.

Bran cakes may be made as advocated by Joslin for the use of diabetics as follows:

Bran	2 cupfuls
Melted butter	30 grams
Eggs (whole)	2
Egg (white)	1
Salt	1 teaspoonful
Water.	

Tie bran in cheesecloth and wash thoroughly by fastening onto the water tap until the water comes away clear. The bran should be frequently kneaded so that all parts come into contact with the water. Wring dry. Mix bran, well beaten with whole eggs, butter and salt. Beat the egg-white very stiff and fold in at the last. Shape with knife and tablespoon into three dozen small cakes. If desired, one-half gram of cinnamon or other flavoring may be added.

Another helpful measure in overcoming the tendency to constipation is the administration of heavy liquid petroleum at night. Usually a tablespoonful of this oil is effectual if taken regularly over a period of time. If the oil is kept on ice or in a cold place, there is little or no taste, and it can be administered either plain or in orange or grape juice.

A glass of hot water before breakfast sometimes acts as a mild laxative, as is well known. The use of fruits, such as figs, prunes, and grapes (the latter eaten with the skins), is most helpful.

Treatment of Chronic Gout. All that has been written concerning the prophylaxis of acute gout is equally true when applied to the subject of chronic gout. The violence of the symptoms of acute gout attract attention, and fewer mistakes in diagnosis are made in this form than in the chronic inflammation due to uratic deposits. The treatment of this or any other condition depends in a great measure upon the correctness of the diagnosis of chronic gout.

Mistakes in diagnosis are frequent. The presence of tophi ordinarily determines the diagnosis, but it is well to remember that not all true cases of gout exhibit tophi and that patients revealing typical tophi may be suffering with other maladies in addition to the gout.

When we have assured ourselves of the accuracy of our diagnosis, the treatment of chronic gout divides itself into:

(1) Dietetic treatment.

(2) Local treatment for the affected joints.

(3) Medicinal treatment.

Diet. The value of frugal and temperate living in preventing attacks of gout has been recognized from the earliest times. It has been long known that an active life with decreased amount of food tends to prevent the occurrence of gout.

Liver, sweetbreads and kidney should be eliminated from the diet, as they contain the greatest amount of purin substances. Roasted or broiled meats are more injurious to the gouty patient than are boiled meats, as the purins are extracted by boiling water. Pratt points out that nearly all soups are made from meat stock, even creamed soups, and hence are rich in purins. All kinds of fresh fruits may be eaten, and sweets are allowable unless the blood sugar content is high.

Local Treatment of the Affected Joints. Hot baths, either general or local baths to the affected joints, are usually grateful to the patient. Massage, gentle in character, with passive movements and the rubbing into the tissues over the joints of various ointments, is a very ancient as well as a modern mode of treatment. In skilfully applied massage there is much greater virtue than in drugs in the treatment of chronic gout. The beneficial effects are not confined to the affected joints and muscles but, as a result of the improved circulation, waste products are more readily excreted and the general health improved.

Hot douches have been used for many centuries in the treatment of chronic joint affections and such treatment is decidedly helpful in treating the arthritic form of chronic gout. To relieve the stiffness and swelling of the joints, alternating jets or sprays are most suitable. Massage reinforces the stimulating and absorbing action of the douches and the patient's general condition is improved as a result of the local measures.

Medicinal Treatment. In chronic gout we deal with a deficiency of elimination, and our treatment may well be directed toward correcting the defects of elimination through kidneys, bowels, or skin.

Alkalies such as bicarbonate of potash in 15-grain doses can be given with benefit twice daily, in combination with a bitter tonic. When constipation exists, the alkali (either sodium or potassium bicarbonate) may be administered with magnesia and rhubarb. Much pure water should be prescribed for its action upon the skin and kidneys.

Iodide of soda and potash have excellent reputations as useful alteratives. There can be no doubt in connection with the painful joints of chronic gout but that iodine is a useful remedy. Three to five grains of the sodium iodide is quite as useful as the larger doses sometimes prescribed. Atophan or tolysin (novatophan), is a decidedly useful remedy and often relieves the joint pains in a most efficient manner. Wine of colchicum, in full doses, is equally helpful at times and should be given a thorough trial before being discarded.

Garrod thought very highly of the resin of guaiac in the treatment of chronic gout, giving 5 grains three times a day. He held that this drug exerted a specific action on the fibrous tissue, and advocated its use in chronic forms of gout with feeble circulation.

Llewellyn also advocates its use as a laxative for constipation in the gouty. He prescribes it combined with equal parts of sulphur and potassium bitartrate.

Treatment of Tophi. Tophi in the neighborhood of joints sometimes become very painful and restrict the movements of the articulations. There are no solvents for these uratic deposits, but massage, hot douches and external application of iodine, is decidedly helpful in relieving the symptoms.

Surgical treatment of uratic deposits when they give rise to pain or restrict the movements of the joints is advisable and the results satisfactory. Healing of the wounds without suppuration is the rule, and in suitable cases surgical measures should be adopted to give the patient the relief that is easily obtainable by skilful use of the knife.

Obesity

BY

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Obesity.

FOREWORD.

It is only within recent years that obesity has been classified as a disease. Until thirty years ago it was scarcely accorded any attention in textbooks on the practice of medicine. The popular attitude toward the obese has varied throughout the ages and in different countries; even now it is considered favorably in Turkey. Julius Cæsar must have preferred fat men, for he says to Mark Antony:

Let me have men about me that are fat,
Sleek-headed men and such as sleep o' nights;
Yond Cassius has a lean and hungry look,
He thinks too much; such men are dangerous.

ACT I, Sc. 2.

A book on the psychology of the obese would be most interesting. Sir John Falstaff alone would fill a large chapter, and Dr. Johnson, unkindly called a behemoth by one of his fair contemporaries, would fill another.

But obesity has its pathetic side; it should be a subject for medical study and assistance and not a target for the caricaturist. Not all cases are exogenous or due to excesses in food and drink. Probably some inherit such tendencies or are brought up amid surroundings that led their fathers or mothers to take on excessive weight. But a large number are endogenous or due to faulty glandular action—a condition we recognize as endocrine obesity. In these cases the cause is due to aberrations in the pituitary gland, the thyroid gland or the gonads.

For each individual there is a normal weight which may be regarded as normal for him at the time and which he tends to maintain under varying circumstances. It requires some effort to change this normal average weight. Any change due to variation in the water content is usually transient and limited to a few pounds. During violent exercise five or more pounds may be lost, mainly from profuse sweat-

ing, and most of this is made good by drinking more liquid. But fat is more stable than water; they are partners, to be sure, in the making of an obese individual but their activities and relative resistance to attempts to dislodge them are obviously very different. Nothing makes such a rapid reduction in the watery content as diseases like Asiatic cholera and yellow fever. The fat does not disappear *pari passu* with the water but it contributes naturally to the total loss in avoirdupois.

Fat is deposited whenever the energy intake of the food exceeds the energy requirements of the body. Immoderate eating, on the one hand, and indolence, on the other, are recognized causes of obesity. Hewlett¹ has summarized our knowledge of metabolism in this regard in his excellent chapter on "Pathological Physiology and Its Relation to Internal Medicine," in Oxford Medicine. Recognizing that some individuals appear to gain weight despite a moderate intake of food and an average amount of exercise, we get the impression that in such individuals the rate of combustion in the body is less than normal, and that in this way food material is conserved and is converted into fat. They conserve their energy by sleeping well, maintaining an even disposition, without worry and without unnecessary movement; excepting in the latter respect there is no accepted proof, according to Hewlett, that the rate of metabolism in the obese individual is different from the normal in any essential particular. The resting metabolism, the liberation of heat after eating and the liberation of heat after exercise, have all been studied and found within normal limits.

The real difficulty lies in a failure to adapt the intake of food to the needs of the body; rather than to charge it to a primary reduction in metabolism. There is an insidious constraint, or at least a failure to resist the temptation to eat day after day more than the body requires; this excess need not be great; it may easily escape detection, but the added increment asserts itself in a gradual gain, and once gained is easily maintained.

"So long as fat is simply stored up as adipose tissue, and between and not within the cellular elements of the body,

it is comparatively harmless, excepting as it indicates a disproportion between functional activity and the amount of fuel taken to develop force, interfering with personal convenience, and causing greater muscular fatigue from the increased work thrown upon the muscles in supporting so heavy a body. The special danger in all cases of this class is that the heart muscle may become affected in this manner, which renders it liable to cease beating whenever the slightest additional strain is thrown upon the circulation. Thompson instances a woman weighing one hundred and twenty pounds at 20 years and two hundred and forty pounds at forty years. In doubling the size of her body she has the same size of heart to maintain the circulation that she had at 20 years, but she has more work to do, for every time she walks or climbs a flight of stairs she raises the additional one hundred and twenty pounds of dead weight" (Gilman Thompson).

A GENERAL CONSIDERATION OF OBESITY.

THE FORMATION OF FAT.

Adipose tissue is not as simple in its structure and function as was formerly believed. Seventy years ago and for many years after, it was held, according to the teaching of Virchow in his "Cellular Pathology," that fatty adipose tissue is merely a common connective tissue loaded with fat. This remained unchallenged until 1870, when Toldt first stated that the fatty tissue of mammals is a specific organ entirely distinct from the connective tissue.* He recognized that beside the usual fat deposits, the cells of which, derived from the primitive fat organ of the early fetus, form lobulated structures with an independent and characteristically glandular type of blood supply; there also occur irregular deposits of fat in connective tissue not possessing these features and returning to their original connective tissue structure and function when the fat is reabsorbed. It would seem that both types of fatty tissue exist, the glandular type being the more important and abundant. It is supposed that fat soluble vitamins are stored in the glandular adipose

* We are indebted to an editorial in the Journal of the American Medical Association, Oct. 23, 1920, for a discussion of this subject.

tissue. The conclusion is drawn from studies, which we do not need to rehearse, that there are at least two and probably three types of adipose tissue, namely: ordinary connective tissue, storing surplus simple fats; glandular adipose tissue, storing lipoids with varying amounts of simple nutritive fats; and glandular adipose tissue, with close functional relationship to the endocrine glands.

Dr. S. Weir Mitchell,² in one of his best known books, "Fat and Blood," published in 1877, discusses gain and loss of weight in a very interesting manner. It was the custom at the Infirmary for Nervous Diseases where Dr. Mitchell held clinics, to weigh patients when they entered and at subsequent intervals, and Dr. Mitchell took pains to also record their height, not doing, as a recent writer complains so many do, that is, weigh them when alive and measure them after they are dead. Dr. Mitchell was chiefly engaged in restoring to health a class of nervous patients generally emaciated and anemic, but not so often in reducing the obese. However, his observations on the fat-making function and his method of accelerating it are famous the world over. He emphasized the fact that it is important to remember that it is almost invariable that loss of flesh occurring rapidly is accompanied soon or late with more or less anemia, and it is uncommon to see a person steadily gaining fat after any pathological reduction of weight without a corresponding gain in amount and quality of blood. Patients, therefore, who lose weight from any pathological cause, are liable to have thin blood as the tissues decrease and richer blood as they increase.

Fatty matter is the one constituent of the body that goes and comes most easily. The loss of fat *which is not due to change of diet and exercise*, especially its rapid or steady loss, nearly always goes hand in hand with conditions which impoverish the blood, while a gain of fat up to a certain point seems to go hand in hand with a rise in all other essentials of health and notably with an improvement in the color and amount of the red corpuscles. He noted that men, as a rule, preserve their nutritive status more equably than women, many of whom lose or acquire large amounts of adipose matter without any corresponding loss or gain

in vigor, and Dr. Mitchell attributed this possibly to the enormous outside demands made by their peculiar physiological processes.

Seasonal Influence. There is a seasonal influence which is apparent in a study of the less fortunate class of men who are hard worked physically and unable to leave town during hot weather. Dr. Mitchell² many years ago was engaged in determining the weight, height and girth of all the members of the Philadelphia police force. The examination was made in April and repeated in October, and it was found that a large majority of the men had lost weight during the summer. The sum total of loss was enormous.

Climate. This has a great deal to do with the tendency to take on fat. In this respect the climate of the United States and of Canada, complex and variable as it is, in such diverse localities, nevertheless does not tend to the development of such *numbers* of inordinately fat middle-aged people as are met with in England and the continent of Europe. It is probable that certain restrictions in the use of alcohol now common to the United States and to a large part of Canada, will accentuate this difference.

Alcohol. If no beer is brewed, nor even malt extract is allowed to be sold, the problem of what to do with the obese may be expected to be easier than in the past, for it was a common observation that alcohol gives rise to an increase of adipose tissue in many cases, especially when malt liquors were taken as a liberal part of the daily ration.

It will be interesting to observe the effect of prohibition, when it actually goes into effect in America, on the occurrence of obesity. Competent observers seem to think that some change has been going on during the last decades, that more fat people, more people even enormously stout, are seen with us than formerly and fewer of the inordinately fat middle-aged people in England than used to be encountered. With us the over-fat are chiefly to be found among the women of the well-to-do classes of the cities and from thirty years old onward. They persecute the medical man to reduce their weight, and the vast number of advertisements of quack and proprietary remedies against obesity indicate how widespread the tendency must be.

Racial Tendencies. These have long been noted. The Jewish race seems to have a tendency to obesity. As a rule these people as they gain in affluence tend to indulge in rich food; but they are not as a race inclined to over-indulgence in alcoholic drinks. They are, however, keen to recognize the advantages offered by spas and all forms of physical therapy commonly used for the relief of obesity. It is probable also that the desire for a better bodily style will have a strong influence in checking these tendencies, as the modern woman, no matter what her race, is now keener than ever to conform to mode in figure and in dress.

RELATION TO THE ENDOCRINE SYSTEM.

Obesity occurs in types of pituitary disease, and in women after natural or artificial menopause. In the latter case there is a deficiency in ovarian secretion that tends to incomplete oxidation and elimination of waste products. In these cases the use of ovarian substance internally has been followed by good results. When the anterior pituitary lobe is overactive during the period of growth or before ossification of the epiphyses is complete, gigantism is possible. This has been designated the *type Lannois*. Hyperpituitarism, coming on later in life, gives rise to acromegaly, the *type Marie*. Hypopituitarism occurring in infancy or early childhood gives a picture of sexual or skeletal infantilism with marked adiposity, which is termed the *typus Fröhlich*. When hypopituitarism occurs in adult life, although the skeleton is developed, there is a reversion of the sex organs to infantile conditions and a great deposition of fat. This latter type is at times spoken of as *dystrophia adiposogenitalis*.³

Disease of the anterior pituitary lobe leads in many cases to an unusual deposit of subcutaneous fat. Possibly not all cases included under such various terms as *adiposis dolorosa* (Dercum's disease), *adiposis universalis*, *dystrophia adiposogenitalis*, and *adiposis cereбрalis*, have pituitary disease, but it should be suspected and demonstrated by x-ray if possible. When actually of hypophysial origin, Cushing attributes the accumulation of fat to a posterior lobe insufficiency and this is generally accepted. He states that all the patients in

the series discussed in his monograph who, after a period of primary pituitarism, began to show evidences of glandular activity, have acquired some measure of adiposity; and an increase of weight has been an early feature in the larger number of those showing signs of primary hypopituitarism.

In both experimental studies and in clinical observation there is a greatly increased power to assimilate excessive amounts of sugar which are then turned into fat owing to an abatement of the sugar metabolizing powers of the body. The symptom complex of adiposity, high sugar tolerance, subnormal temperature, slowed pulse, asthenia, and drowsiness, is thus attributed to a deficiency of the posterior lobe. Cushing remarks that the adiposity of hypopituitarism is a generalized one, not limited solely to the panniculus, and that the fat shows, post mortem, certain peculiarities of color and consistency which suggest a different chemical composition from that of "normal panniculus," and suggests that it is worthy of a differential analysis. It furthermore invades the organs such as the liver, where there is often an extraordinary replacement of the cells by fat globules. Figures 73 and 74 illustrate this in Cushing's work. He attributes hypophysial adiposity to the fact that the posterior lobe secretion contains what may be regarded as a hormone essential to carbohydrate metabolism and this is easily obstructed by divers intracranial lesions.

In the childhood types, the so-called cerebral adiposity, the combination of genital dystrophy and skeletal underdevelopment, with manifestations of cranial disorder, render its recognition easy. In all cases the deposition of fat is fairly universal with, perhaps, a special predilection for the loins, the inner parts of the thighs, the pubes, and the abdomen. The types differ chiefly in the character of dysgenitalism which they display, and in the presence or absence of overgrowth.

In the adolescent types, especially when occurring in the male, and dating from puberty, there is a juvenile skeletal configuration or an outline of feminine type.

In the adult types of adiposity there are some striking examples due to dyspituitarism, for example, gigantism and acromegaly a result, in the later phases at least, of insuf-

ficient posterior lobe activity. Cases of *adiposis dolorosa*, described by Dercum, come under this head. Burr reported in 1900 a typical example of the disease in which a pituitary glioma was found; and in a case of Dercum's, McCarthy found an adenocarcinoma of the pituitary body. Disease of the pituitary is possibly not the rule in Dercum's disease, but it certainly occurs. This distressing disease involves the syndrome of adiposity, tenderness and pains, asthenia and psychoses.

The local obesity of eunuchs is one of their well known features, and as it is customary to perform this mutilation between the tenth and sixteenth years, such individuals put on fat over the buttocks and thighs so as to resemble the female.

RELATION TO DIABETES MELLITUS.

That there is a close connection between obesity and diabetes has long been known. It is also evident that the treatment for both these conditions, at least as regards diet, lies along the same lines. Specialists in diabetes are, therefore, those most liable to meet in their practice those who are markedly overweight.

Recently Joslin⁴ has again called attention to this subject. His first record of one thousand and sixty-three cases of diabetes in his own practice showed that in more than forty per cent., marked obesity preceded the outbreak of the disease, and the prediction was made that if more exact data were available the percentage would be fully twice as great. A prediabetic stage in fat persons was recognized as possible by Joslin and von Noorden, who emphasized the necessity of examining the urines of such persons for sugar; and further, that examinations of the blood sugar of these subjects would disclose their approach to the disease when the urine was still sugar free.

A study of one hundred and eighteen diabetics, made in the laboratory of the Carnegie Institution in Washington, in whom the height, weight and age were recorded, showed the interesting fact that persons about the age of fifty rarely acquired diabetes if their weight remained a little below

normal, and the study emphasized the connection between obesity and diabetes.

Joslin then undertook the study of one thousand cases, in which age, weight and height were known to have been compiled. Incidentally he criticizes the strange failure to measure the height in making the case records. It is notorious that fat people underestimate their weight and this is not confined to either sex.

The tables in this study show that among one thousand diabetic persons there was no instance in which diabetes occurred when the maximum weight was thirty-one or more per cent. below the normal zone; whereas there were two hundred and seventy-three persons who developed the disease who were thirty or more per cent. above it.

Taking a pair of groups nearer the normal zone for weight, namely, between twenty-one and thirty per cent. below and above normal, there were found five cases below and one hundred and sixty-nine above normal. Consolidating this pair of groups with the pair first mentioned, it is found that in one thousand diabetics there were five who showed a maximum weight twenty-one or more per cent. below normal and three hundred and ninety-four whose maximum weight was twenty-one or more per cent. above normal. Therefore in this series when the persons were twenty-one or more per cent. over weight diabetes occurred seventy-nine times as frequently as when in the corresponding degree of underweight. Joslin emphasizes his belief that diabetes is a penalty of obesity, and the greater the obesity the more likely is Nature to enforce it. He scoffs at the "fat diathesis": "granted that there is one person in a thousand who has some inherent peculiarity of metabolism which has led to obesity, there are nine hundred and ninety-nine for whom fat implies too much food, or too little exercise, or both combined."

In the attempt to induce obese persons to correct this preventable and dangerous condition, there are phases of the incidence of diabetes that should be mentioned. Joslin formulates the following law: It is rare for diabetes to develop in an individual above the age of twenty years who is habitually underweight and when it does so develop, the

case will usually be found to be extremely severe, extremely mild, or associated with a marked hereditary taint or degenerative stigma. Joslin goes so far as to say that obese individuals should be frankly told that they are candidates for diabetes. How many of us will have the courage to do this, granted that the argument is correct?

A slight trace of sugar is not very uncommon in obese persons; but this lipogenic glycosuria is not of grave significance and is only occasionally followed by true diabetes. Diabetogenous obesity in early life is very unfavorable.

LIFE EXPECTANCY AND MORTALITY IN THE OBESE. STANDARD WEIGHT.

A committee representing the Association of Life Insurance Medical Directors and the Actuarial Society of America has published valuable tables showing the influence of build on mortality among men and women. It would appear that for men, taking all ages at entry into insurance, there is a steady increase in the mortality with increasing weight.⁵

Weight	Ratio of deaths to expected.
Over 15 to over 20 pounds	104
Over 25 to over 30 pounds	113
Over 35 to over 40 pounds	131
Over 50 to over 60 pounds	144
Over 65 to over 80 pounds	165
Over 85 and more pounds	223

Overweight to a moderate degree is not a serious impairment at the young ages of entry but has a material effect at the middle ages. For example, in the age group 20 to 24 the mortality among those fifty to eighty pounds overweight was three per cent. in excess of the standard; while in the age group 40 to 44 it was seventy-five per cent. At the ages of entry 50 to 62, it does not appear that from twenty-five to eighty pounds above the average weight is as serious an impairment as at ages 40 to 49. The mortality of those more than twenty pounds overweight reaches a maximum at entry age 40 to 44.

In the report referred to there are interesting tables of mortality arranged for attained ages and for height and weight

in men whose policies terminated (the experience of the first five policy years was excluded). For example:

Height 5 feet, 3 inches to 5 feet, 6 inches.

Over 35 to over 45 pounds.

Attained ages 27 to 36	Ratio 100 per cent.
Attained ages 37 to 46	Ratio 133 per cent.
Attained ages 47 to 56	Ratio 155 per cent.
Attained ages 57 to 66	Ratio 171 per cent.
Attained ages 67 and over	Ratio 115 per cent.

Over 50 to over 60 pounds.

Attained ages 27 to 36	Ratio 85 per cent.
Attained ages 37 to 46	Ratio 186 per cent.
Attained ages 47 to 56	Ratio 195 per cent.
Attained ages 57 to 66	Ratio 193 per cent.
Attained ages 67 and over	Ratio 192 per cent.

Over 65 to over 80 pounds.

Attained ages 27 to 36	Ratio 33 per cent.
Attained ages 37 to 46	Ratio 200 per cent.
Attained ages 47 to 56	Ratio 257 per cent.
Attained ages 57 to 66	Ratio 133 per cent.
Attained ages 67 and over	Ratio 300 per cent.

These ratios were somewhat less for the greater height group of 5 feet 7 inches to 5 feet 10 inches.

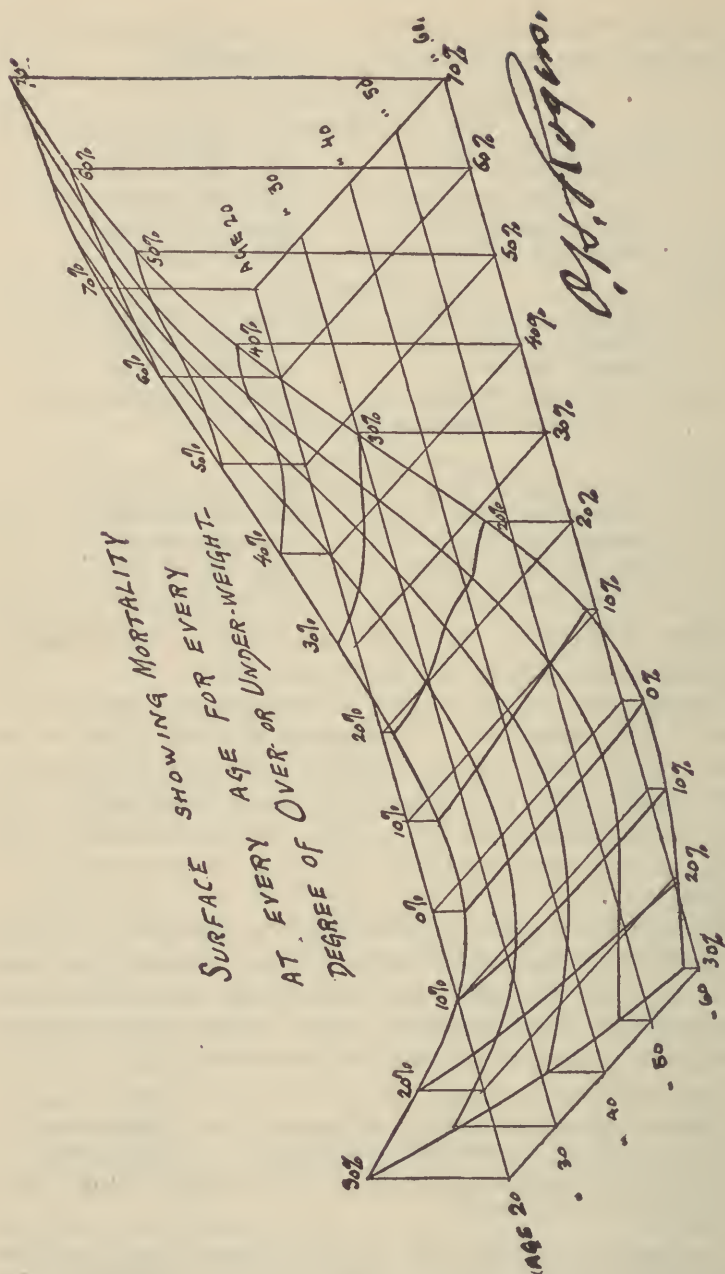
Obesity does not predispose to tuberculosis; on the contrary it is a safeguard. Taking men at entry at 30 to 44 years of age fifty pounds or more overweight, compared with those twenty-five pounds or more underweight, the ratio of mortality is as 1.8 to 16.5. So the fat man is not very liable to consumption.* His fat is an asset and not a liability.

If weight and *girth* are in excess the expectation of life is considerably impaired. Taking a group of risks thirty per cent. to thirty-nine per cent. overweight, with excess abdominal girth when compared with a similar group without such girth, it was found that the mortality was:

Excess girth not exceeding 1 inch	107 per cent.
Excess girth not exceeding 1.25 to 2 inches	114 per cent.
Excess girth not exceeding 2.25 to 3 inches	130 per cent.

In a group 40 to 49 per cent. overweight the figures were 103 per cent., 127 per cent. and 144 per cent.

* The author is indebted to Dr. Oscar H. Rogers of the New York Life Insurance Co. and to Mr. F. L. Hoffman of the Prudential for the opportunity of examining interesting data.



Rogers⁶ has constructed a sketch to show in perspective the mortality to be expected by reason of build alone, without regard to any other factor. The plane represented by the horizontal lines represents the mortality in his company. The age lines, "age 20," "age 30," "age 40," etc., show the age of each group. The lines running at right angles to these age lines represent the degree over- or underweight, seventy per cent. overweight, sixty per cent., fifty per cent., etc., down to thirty per cent. underweight. The curved line which extends at age 20 from twenty per cent. underweight to seventy per cent. overweight shows the mortality either over or under the tabular, due to the build, *i.e.*, to the degree of over- or underweight.

It will be seen from his diagram that at the age 20 and twenty per cent. underweight, the mortality is fairly high and that it falls to the normal at ten per cent. underweight; and that the mortality continues below normal, *i.e.*, is better than the tabular, up to about twenty-three per cent. or twenty-four per cent. overweight and that thereafter the mortality rises rapidly until, at seventy per cent. overweight, the degree of mortality is quite high as represented by the vertical line between the plane of tabular mortality and the curve. In the same way, at age 60, the mortality at thirty per cent. underweight is very slightly in excess of the normal; the curve of mortality meets the normal plane at about twenty-three per cent. underweight, after which the mortality is below the normal up to about eight per cent. overweight and from that point it rises rapidly until we have the excessive mortality represented by a vertical line which rises from the age 60 line.*

INSTANCES OF EXTREME OBESITY.

We are familiar with the grotesque pictures of the fat habitues of the English spas of a century or more ago. Rowlandson depicted these in the most ungainly attitudes in the pump room at Bath and in their uncouth dress they make the impression that none such as these are seen today. Excessive obesity is not by any means a thing of the past,

* For normal standard weight, according to sex, height and age, see Mohler's article on Diabetes, Vol. I, pp. 739 and 740.

nor is it found only in England or on the continent of Europe. The writer has a photograph of a phenomenally fat man who lives at Waycross, Georgia, and is said to have attained the extraordinary weight of six hundred and ten pounds. He was 55 years old in February, 1921; his height is six feet, two inches, and weighs five hundred and fifty-five pounds, but recently lost fifty-five pounds owing to business and domestic worry. His general health is good and he has no



The grand pump room, Bath, 18th Century (*after Rowlandson*).

disease such as diabetes. The assigned cause for obesity is heredity. His normal weight is 603 pounds.

Only a few months ago, in November, 1920, a wedding is reported to have taken place in Santa Ana, California, the bride tipping the scales at seven hundred and twenty-five pounds. The account of this wedding gives the interesting information that the bride's sister is living and weighs four hundred and twenty pounds. The photograph of the lady on her wedding day shows that the estimate of her weight may be trusted. In a little over a year her death was reported.

A third American whom we have to record died in Bristol, England, within a year, weighing six hundred and sixty-

eight pounds, and travelled all over the world as the heaviest woman in the world. She was a native of Kentucky.

Mr. Charles H. Jackson, said to have been the largest man in the world, died in Cambridge, Massachusetts, on July 7, 1921. His age was 61; height, six feet; and weight, in 1916, was six hundred and thirty pounds. During the ensuing year he gained eighty-three pounds and steadily increased



Case of Mrs. J. H. H.

in weight until his health began to fail in 1916. He worked as a foreman in a brass foundry, and left three children: a son weighing about one hundred and sixty pounds, and two daughters, said to weigh about three hundred pounds each. He was in a hospital for four months previous to his death. There was no autopsy.

Mrs. Fannie Cumberland, aged 47, died in Minneapolis, Minnesota, on March 1, 1921, weighing six hundred pounds. For twenty-five years she had weighed over five hundred

pounds, was married and had no children. Her physician informs me that she had never had diabetes and that she died of chronic interstitial nephritis of three years' duration, with dropsy. As far as he knows she never took any treatment for overweight. Her height was five feet, nine inches.

In January, 1919, there died in Bridgeport, Connecticut, Mrs. Matilda Gilbert, who toured with Barnum's circus and weighed four hundred and twenty pounds just before her last illness, which was from pneumonia following influenza, epidemic throughout the country at that time.

These six cases are therefore all indigenous to the United States, and are from widely separated localities. What their habits were we cannot say, nor do we know whether they ever tried seriously to change their mode of life.

The English record for men seems to have been held by Mr. Thomas Lambert, who died in 1809, and who weighed seven hundred and thirty-eight pounds. His waistcoat, said to be in the Lynn museum, is reported to measure one hundred and two inches around.

There is one tendency of obese persons that is almost unique and that is their gregarious instinct. There are associations or societies that are more or less well known, and their convivial and gastronomic doings are recorded from time to time in the public press. Unlike the United States Hay Fever Association, these clubs do not seem to have contributed to the literature or therapeutics of their disease. The most famous of the fat men's clubs is the "Cent Kilos," of Paris, which has over three hundred members, all weighing over two hundred and twenty-five pounds. Before the recent war the attendance at their annual gatherings exceeded five hundred. They have weekly Sunday gatherings at a restaurant in the Rue Folies Mericourt, where with due solemnity they imbibe the two liters of heavy red wine allotted to each member besides the five courses of substantial proportions considered essential to maintain adiposity.¹⁵

In the United States these gatherings take the form of clam-bakes and always excite popular interest.

TREATMENT.

PROPHYLACTIC.

Prophylactic treatment is more easy than to remedy the disease when well established; but in practice the majority of patients are those who between forty and fifty years of age have already entered the heavy-weight class. When a family tendency toward obesity manifests itself in earlier life the patient should at once be placed on a régime, the opportunity for carrying out physical measures being much greater at that period.

The general plan, therefore, will be to combine several measures. There must be coöperation and a very earnest desire to reduce. It must be sufficient to insure the patient's making sacrifices. The appetite must be controlled. Sweets of all kinds are to be reduced to a minimum; starches and fats likewise.

A disease like obesity is eminently suitable for psychotherapy. It is highly desirable to arouse the interest of the patient, stimulating his ambition and affording encouragement as the treatment progresses. Where the will is weak it must be strengthened, and the physician's duty is to teach and inspire him to cure himself. This will include much self-denial and the fortification against the prejudices and possible discouragement from friends and relatives; but the modern trend of popular medical teaching and the dictates of fashion are lending a steadily increasing support to various plans of treatment toward this end.

What is the best time to adopt prophylactic measures against the occurrence of obesity? Perhaps we can answer that question by recalling what an eminent physician is reported to have said apropos of rheumatism. "Madam," said he, "if you had come to me twenty years ago I could have cured you; now I can do nothing for you." "But, Doctor, I didn't have rheumatism twenty years ago." "No, Madam, but the causes were there; I could have removed them." Five years later the woman's daughter walked into the office of the same physician and said: "I wish to be cured of rheumatism." He examined her thoroughly. "What do you mean?" he said, "You haven't rheumatism." "No, but

I am following your advice and coming twenty years ahead of my rheumatism."

Substitute the word "obesity" for "rheumatism" and we have a situation reflecting the same truths and the same prophylactic problems. Certainly the best time to cure obesity is before it begins; before hereditary or acquired tendencies render a cure arduous or even impossible.

METABOLISM IN THE OBESE.

The only paper on this subject we are familiar with in American literature is by Means.⁷ The cases studied included that of a woman of forty-eight years, weighing two hundred and forty-five pounds, who by dieting and fasting was reduced to two hundred and eleven pounds in two and one-half months. The increase of weight dated from the birth of her first child, nineteen years previously, and, aside from a large ventral hernia at the site of a previous operation, her general health was excellent. She took very little exercise. Her systolic blood-pressure was 120; diastolic, 90; hemoglobin, 80 per cent., and a roentgen ray examination of her head showed a normal sella turcica. Three absolute starvation periods of six, five, and four days, were instituted, and complete details of the basal metabolism, materials katabolized, the respiratory quotient, the fluid intake, the urine, the pulse rate, and the daily body weight, are given. Three other cases of obesity, one weighing three hundred and ninety-seven pounds, were likewise studied and reported on. Means also details studies of metabolism by foreign observers in seventeen obese cases in which the surface areas were calculated. The full particulars of all of these cases are well worth study as given in this paper. The results show that the basal metabolism of the two cases of simple obesity, using the DuBois formula for body surface, was normal. One case, however (Case IV), which was one of undoubted hypopituitarism showing marked obesity, had an increased basal metabolism.

An interesting and important observation on the administration of thyroid is given by Means. During its administration to the obese there seems to be an increase of metabolic activity. Jaquet and Svenson, in three cases, however,

did not find any rise in metabolism while on thyroid, or any striking change in the respiratory quotient. They hold that the loss of weight in the obese during thyroid administration may be entirely due to loss of water or, in some cases, to actual tissue destruction. Magnus-Levy came to the same conclusion.

On the other hand, Thiele and Nehring, in a woman of one hundred and twenty-four kilograms (two hundred and seventy-three pounds), noted a rise in basal metabolism of thirteen per cent. Bergman's case gave a twenty-five per cent. rise. Means's case was put on thyroid, with an initial dose of 1.5 grains per day, gradually increased to nine grains per day, on which she remained five days. The result was that there was a definite rise in metabolism and in nitrogen elimination, the nitrogen balance becoming negative after she had been on thyroid for a week.

This patient lost weight rapidly, but Means thought this may have been due to loss of fluid, since the amount of urine increased. The pulse rate showed a marked rise. The patient had no subjective symptoms, such as feeling nervous. The respiratory quotient showed a tendency to rise above its usual figure. She burned twice as much or more carbohydrate as when on the same diet without thyroid. The increase in protein metabolism was not sufficient to explain the rise in the respiratory quotient. The katabolism of fat during the thyroid period was about the same as without thyroid and that of protein somewhat increased.

Thus it appeared that in this patient the effect of giving thyroid is to increase the basal metabolism. Also the increase is met by an increased combustion of carbohydrate and protein and not of fat. Moreover, the increase in the case of the carbohydrate is greater than in that of the protein.

The conclusion is that thyroid produces a greater utilization of carbohydrate, it being burned instead of being stored as fat.

The loss of weight may have been entirely due to loss of fluid. The loss of body protein was not great enough to become alarming but might easily have become so if the dosage had been continued.

We have detailed the results of this admirable study because the use of thyroid is so largely empirical, the *modus operandi* is so little appreciated. The conclusion of the matter as based on the cases cited is that any destruction of body fat is lacking; "so it does not seem reasonable to suppose that thyroid will cure obesity by actually causing the burning of the excess of fat. On the other hand, by producing a better utilization of carbohydrate it might act beneficially in preventing further formation of fat from carbohydrate and so be an aid to the dietetic treatment of the condition. Whether this action can be secured by smaller doses of thyroid will have to be determined in future experiments. The dosage used here owing to its effect upon circulation and body protein could not be used for any considerable length of time. The above statements must not be interpreted as a recommendation of thyroid in the treatment of obesity. It is well recognized that it is not necessary and also that grave dangers may result from the incautious use of it."

When first introduced thyroid was a very popular treatment for obesity. Like all new measures it was overdone and bad effects were noted. This was doubtless due to the large doses used. Ebstein formulated an argument against its use, claiming that loss of weight produced by it is quite inconstant and always ceases at once with its discontinuance. He warns against the danger in the loss of body albumin. He believes it to be quite unnecessary, inasmuch as we have dietetic rules for the treatment of obesity that are as successful as they are devoid of danger.

However, the later practice seems to allow its use in small dosage, one-half or one grain three times a day. We have used it in this manner, with close supervision, apparently without any bad effect. There is a large commercial demand for thyroid and probably it is prescribed by physicians or given surreptitiously to the obese more frequently than textbooks would indicate. (See page 756.)

Thyroid extract should be used only in cases showing definite symptoms of hypothyroidism. In obesity of the type of Fröhlich thyroid would not be indicated but rather the pituitary extract, whether it is the whole gland or the an-

terior lobe which is considered the responsible factor. It is claimed on good authority that a combination of a tablet of the whole gland with a tablet of anterior pituitary gives better results than either one given singly.

When obesity is observed in women near the menopause and is due to ovarian dysfunction, ovarian substance in five grain tablets may be employed.

DANGERS OF "ANTIFAT CURES."

The United States Department of Agriculture, through its Bureau of Chemistry, has made tests of various nostrums advertised by the promoters of fat reducing cures and many have been found worthless and even dangerous. The advertisements appeal to the vanity of people who wish to regain graceful figures, and also to the business necessities of those who become so fat that they cannot do their accustomed work. Unfortunately the Department will not publish or divulge in any manner the names identifying these so-called remedies unless the Post Office Department should issue a fraud order denying them the use of the mails. This is done in only a small proportion of cases. The Bureau's work, is, therefore, in most instances of little more than academic interest. Its practical value to the public is to that extent lost. However, in one instance the Bureau tried out "one of the most widely advertised so-called prescriptions for reducing flesh." Employees of the Department who wished to lose surplus flesh without injuring their health, volunteered as subjects but the result was that two of the subjects under experimentation were obliged to stop after taking the medicine for two or three weeks because of its injurious effects. The third subject gained two and one-half pounds instead of losing flesh.

Another of the so-called remedies of a "Great Obesity Specialist" was tried. The subject scrupulously followed the diet list which accompanied the remedy, and faithfully carried out the system of exercises recommended. After six months' treatment there was reduction of eighteen pounds of flesh, but this the experimenters attribute to the fact that the subject ate no bread, butter, starchy food, pastry, sugar or candy while under observation. The first month after

discontinuing treatment the subject gained ten pounds and in three months was back at the old weight.

The promoters of one preparation assert that it secures most marvelous results by a process of elimination of foods without digestion. These people guarantee a loss of a pound a day. Another scheme provides chemicals to be added to the water in which the patient is to bathe. The chemicals are of such a nature as to form a sort of curd in the water after the patient has bathed. This curd, the advertisement states, is fat and surplus tissue removed from the body. Then there is a kind of bread at the modest price of a dollar a loaf that in connection with a certain diet is claimed to do wonders.

It would appear that women are usually the victims of these promoters or "professors" or fakers, or whatever we may choose to call them. The strong feature of most of the literature is that no dieting is necessary; the medicine is all-sufficient. The experience of the Bureau is that these preparations usually contain thyroid extract and a laxative, or phytolacca (poke weed), both of which may be dangerous in the hands of ill-advised persons. The Bureau states that it has the record of a case in which death occurred from overdoses of thyroid extract.

We cannot understand why laws should not be enacted by which some precise information can be given out by the Department as to the names or brands of these dangerous or fraudulent preparations.

In the case of thyroid extract there is a great practical difficulty, as we do not know of any chemical test whereby the presence of this organic substance can be detected. There are physiological tests, however, by which samples of thyroid extract can be tested so as to ascertain whether they measure up to a standard. This requires complicated laboratory facilities.

In giving thyroid extract to obese patients it has occasionally been found that sugar appears in the urine and a diabetes ensues. This observation should make us cautious to examine the urine and blood sugar frequently in cases undergoing thyroid treatment. As we have previously noted,

the incidence of diabetes in those over weight is greatly above that noted in persons of normal weight.

Purgative treatment has been likewise abused and consequently condemned; but as an adjunct to other measures mineral waters have a legitimate place in treatment, especially at the outset. The Hathorn of Saratoga; Pluto, and other fortified waters, are extensively used, as well as foreign waters such as Hunjadi and Apenta.

When they seek treatment the obese frequently do so because of a rebellious liver, overloaded colon, or for some kidney or hepatic condition. Gall-stones are more common in the obese than in the thin. Hence it is that mineral water resorts, catering to bilious patients and with some reputation for dissolving gall-stones, will therefore attract corpulent people; dietetic restrictions in vogue at these resorts incidentally help them.

Cases of obesity are met with showing a history of some earlier tuberculous trouble, either glandular or pleural, or of the bronchi. In such cases too vigorous treatment of the obesity has caused a flaring up of long latent disease; hence there should be a search for signs of tuberculosis before instituting treatment and no debilitating measures should be allowed; at the same time strict supervision is desirable throughout the course. The measures should aim not only to reduce the fat and insure its more perfect oxidation but also to restore nerve and muscle force, modifying the diet completely, without rendering it distasteful, with exercise and plenty of water between meals.

Attention has been called to these dangers by De Fleury,⁸ who allows one small tumblerful of water with the meals, one on rising and retiring, with another at 9, 10 and 11 A.M., and again at 4, 5 and 6 P.M. A half hour of exercise, out of doors, three times a day is advised. He also advocates the Bergonie method of prolonged and frequently repeated faradization of whole groups of muscles at once. (See page 782.) DeFleury has obtained great benefit from very small daily doses of thyroid extract; but claims that even better effect can be obtained from repeated subcutaneous injection of small amounts of a hypertonic artificial serum. The solution used is composed of eight parts of sodium sulphate, four

parts sodium phosphate, two parts sodium chloride, and one hundred parts of water. This serotherapy stimulates the internal secretions and this in turn promotes the metabolism, and the appetite increases while the food is utilized better.

A distinction has been made between obesity cures and emaciation cures. While the former involves the loss of only superfluous fat, in the latter both fat and muscle are diminished. "Starvation cures" and "hunger cures" are alike and really mean nothing more than emaciation cures or, as the French say, "*la cure d'amaigrissement*."

In obesity cures we should aim at depletion without bringing about inanition or malnutrition. The depletion should not go to the extent of loss of muscular substance. The whole system of reduction might do great harm. Ebstein has insisted that the no-fat cure, for example, is one of these dangerous practices and "may produce severe organic disease of the kidneys." But he points out that the danger is somewhat mitigated inasmuch as even lean meat contains as much as two per cent. of fat. Of course it should not be forgotten that milk also contains fat.

Probably a strict no-fat cure is not adopted by anyone at present. Fat is a necessary food. Ebstein maintains that "it is sufficiently proven by experience that even in fat persons the ingestion of a measured quantity of fat under certain circumstances fails to produce any accumulation of fat, and that the person in question may even rid himself of his superfluous fat provided that the carbohydrates are properly limited and that the manner of living is otherwise normal and in accordance with the fundamental laws of the modern physiology of nutrition." He cites the observation of Hippocrates in advising for the obese the ingestion of foods prepared with fat, as in this manner the appetite was more easily satisfied.

It has been remarked that in its ultimate analysis the problem of obesity may resolve itself into a question of nutritive bookkeeping, that is, of the relative balance between food intake and energy output.⁹

Now that caloric values for food and the careful estimate of the weight of every article composing it are considered indispensable in ordering diets, a great many problems arise

in particular cases. One of these is that the body weight does not always fall *pari passu* with a reduction in the food allowance. It was probably a question like this that started Sanctorius on a physiological investigation of the relation of the food intake to the excretion of it. He regulated his food so as to preserve an even balance and weighed himself daily.



Sanctorius and his balance. (1561-1636) *De Statica Medicina*.

POPULAR REDUCTION CURES.

In England, in 1863, Mr. William Banting published his letter on "Corpulence," addressed to the public. He stated that in 1862 he was sixty-six years of age, five feet ten inches in height and weighed two hundred and two pounds. He was of active and regular habits and (as he believed) did not indulge in anything to excess. There was no hereditary tendency to corpulence. He took more exercise, especially rowing, but his appetite grew and he felt constrained to satisfy it. He took ninety Turkish baths and "gallons of physic." He took to "riding on horseback, the waters and climate of Leamington, Cheltenham and Harrogate, and

spared no expense in consultations with the best authorities in the land." But all this did not avail, for he says he could not stoop to tie his shoe and he had to go down stairs slowly backwards. But under a diet, which Mr. Harvey, of Soho Square, had learned from M. Bernard's lectures in Paris on diabetes, he found the famous cure for corpulence. Mr. Banting lost thirteen inches in bulk and fifty pounds in weight in a year. His health returned; he ate and drank and slept well, had no indigestion and could stoop with ease and freedom. He suffered no longer from faintness and his personal appearance was greatly improved. The forbidden foods were bread, butter, milk, sugar, beer and potatoes. Mr. Banting's view was that "saccharine matter is the great moving cause of fatty corpulence."

The following dietary is simple but it is obviously unsuited to those having any signs of nephritis as it is highly nitrogenous, and the wine, whisky and brandy are probably superfluous, and in America, at least, well nigh unobtainable.

Breakfast (8 to 9 A.M.): Four or six ounces of beef, mutton kidneys, broiled fish, bacon, or cold meat of any kind except pork; a large cup of tea (without milk or sugar), a little biscuit, or one ounce of dry toast.

Dinner (1 to 2 P.M.): Five or six ounces of any fish except salmon, any meat except pork, any vegetable except potato; one ounce of dry toast; fruit or pudding; any kind poultry or game; and two or three glasses of good claret, sherry or Madeira-champagne; port and beer forbidden.

Tea (5 to 6 P.M.): Two or three ounces of fruit, a rusk or two, and a cup of tea without milk or sugar.

Supper (9 P.M.): Three or four ounces of fish, similar to dinner, with a glass or two of claret.

Nightcap (when inclination directs): A tumbler of grog (gin, whisky, or brandy, without sugar), or a glass or two of claret or sherry.

In 1887 Mr. J. H. Salisbury of New York, published a "Brief Statement of the So-called Salisbury Plan for the treatment by Alimentation of Various Diseases Produced by Unhealthy and Indiscrete Feeding." It was intended to influence various diseases of the digestive system and those "associated with excessive development of either the connective or fatty tissues." The essentials are the taking of hot water, and a diet consisting of about two-thirds lean meat and one-third vegetables.¹⁰

The water should be taken as hot as the patient can bear it; one pint in bed in the morning or on rising, one pint

one hour and a half before each meal, and half an hour before bedtime. It should be slowly sipped, so that the time taken be five to fifteen minutes, uncomfortable distention being thus avoided. If there be thirst between meals, the patient may take hot "clear" water, lemon water, or "crust coffee." At meals, five to eight ounces of clear tea or clear coffee is allowed. Food should be either the muscle pulp of beef, broiled, broiled beef-steak free from fat, roast beef, broiled or roasted lamb or mutton; boiled fish; chicken, game, and turkey, broiled or roast; salt, pepper, Worcester sauce and chutney in moderation; celery. All meats should be fairly well cooked, and meals should be taken regularly, either alone or in the company of others taking the same diet.

It is claimed that under this system adipose tissue will rapidly disappear, the loss of weight being at the rate of ten pounds to thirty pounds per month, according to the degree of fatness, the strictness of the diet, the amount of exercise, and the mental condition of the patient. If the loss of weight be too rapid, so that the skin hangs in folds, such food as bread, toast, rice, cracked wheat, and potatoes may be added. The loss of ten pounds to fifteen pounds a month is advocated as the ideal rate of weight reduction. When the desired weight and bulk have been reached, the fat-forming foods should be taken in such proportion as may suffice to maintain them, usually two parts of meat to one part of vegetable bulk. It is stated that the relish for beef may become so great that from one to two pounds may be taken at each meal.

The body should be washed twice daily with soap and water, and afterwards rubbed with equal parts of glycerin and water. Regular exercise, short of fatigue, should be taken; or, where this is impossible, the body should be well rubbed from head to foot for from ten to twenty minutes three times daily. Flannel or silk should be worn next the skin, and the body be kept comfortably warm. All methods calculated to maintain health should be observed.

The above diet will cause most people to lose weight quickly. Before advising anyone to rigidly adhere to it, however, it would be well to exclude the existence of chronic

granular nephritis. A dietary with so great a proportion of nitrogenous food will tax severely any but the healthiest kidneys.

About twenty years ago the late Mr. Horace Fletcher¹¹ published several works relating to diet and the hygiene of food. They made a strong appeal for more moderate and better habits of eating. The chief points in Fletcher's system included: early rising; no breakfast; one meal daily about 1 P.M.; a moderate selection of foods; thorough and prolonged mastication.

This last was the essential feature of the system which soon became known as Fletcherizing—a term which has maintained itself in our vocabulary for over twenty years. It is the overcorrection of what is undoubtedly a very bad habit; and this habit is common to many besides the obese. Horace Fletcher is therefore included in a trio, with Mr. Banting and Mr. Salisbury, who have had a marked influence in dietetics and an enthusiastic following. Among the distinguished followers of Fletcher was the late Right Hon. W. E. Gladstone, who practiced the method faithfully and insisted on thirty-two chewing movements for each mouthful. "Munching parties" became popular in England and made "epicures" of many whom Fletcher denounced as "gluttons."

There is a valuable lesson to be derived from the details of Mr. Fletcher's own case as published in "The New Glutton or Epicure." In 1898 Mr. Fletcher was forty-nine years old and five feet, seven inches, in height. His extremes of weight for fifteen years in ordinary clothing were: minimum, one hundred and ninety-eight pounds; maximum, two hundred and seventeen pounds. Chest measure, forty-two inches; waist, forty-three to forty-four inches, and usual weight two hundred and five pounds (June 1, 1898). By October 10th, as the result of experiments, he weighed one hundred and sixty-three pounds; the chest measure was the same, but the waist measure was reduced to thirty-seven inches.

One meal a day was taken. He rose at or before daylight and began writing or other work. He says that by one o'clock he usually was "worked out" but had already disposed of practically a day's work. Then in the middle

of the day, when all the animals rest and some of them chew the cud, he took his meal, for which he had an epicurean appetite.

"The article of food on the menu that first attracted me I fixed my desire upon. At the time it was usually a meat or a fish, and there accompanied it only a cup of coffee, nine-tenths milk, bread and butter and potato. Sometimes the meat selected was an *entrée* and was garnished with rice and other vegetables or fruits.

"About thirty mouthfuls of these, disposed of in something less than twenty-five hundred acts of mastication or other movement of the mouth, and taking about thirty to thirty-five minutes, satisfied the appetite so perfectly that all the ices and desserts on a sumptuous bill of fare had no attraction. In the meantime water was drunk, in small portions only, and ice water at that, without restriction to satisfy thirst *but not* when any food was in process." Fletcher notes that water injures digestion by being taken with meals only because it is used to wash down food not yet prepared for the stomach. "It is the unfit food that is carried down by it and not the water that does the harm."

Horace Fletcher's books unfold the philosophy of rational eating; they may be considered extreme but the tests have a decided scientific interest, as they were conducted for several months on Mr. Fletcher by Dr. William G. Anderson and Prof. Russell H. Chittenden in their laboratory at Yale University. The technical account was published by them in the *Popular Science Monthly* in June, 1903.

It may be mentioned that Mr. Fletcher was given the same set of exercises that were given to the Yale Varsity crew and he took them with an ease that was unlooked for and with fewer noticeable bad results than in any man of his age and condition they had ever worked with. The later test of work was accomplished on two meals a day, having a nitrogen value of less than seven grams daily, as compared with about one hundred in ordinary working men; the food represented less than sixteen hundred large calories, and the heat-economy-showing was verified later in a thirty-two-hour calorimeter measurement in the apparatus of Professors Atwater and Benedict at Middletown, Conn. The

body weight was maintained all through at about one hundred and sixty-five pounds. These studies were conducted in January and February, 1903. The details are very interesting to anyone studying human nutrition.

USE OF WATER.

It is a mistake to suppose that the mere drinking of some mineral water will cure obesity. Mineral waters have no specific action upon adipose tissue, although helpful in so far as a daily action of the bowels is concerned and as far as they may be used externally in hydrotherapy. We will mention hydrotherapeutic measures later on.

The rôle of water metabolism in obesity has been studied by Grafe,¹² and it has an important bearing on the results of dietary treatment. His patients were kept in bed during the whole course of treatment and strictly isolated.

The response to the respiratory tests refuted the assumption that obesity is due to disturbance in the oxidation of fat. Some of the patients, especially those with slight disturbance of the circulatory system, lost weight rapidly on reduction of the food to fifty per cent. of the normal requirements; the weight of others scarcely declined even when the nourishment was only thirty per cent. of the requirement, and the weight then kept constant for a long time. The tests showed that this was due to an extreme tendency to retention of water, although the cardiovascular system and the kidneys seemed to be normal. The retention of water from the food may keep the weight at a constant level although the body is constantly losing more and more of its dry constituents. This tendency to retention is far greater than corresponds to the prolonged underfeeding, even with very small intake of fluids. This is the reverse of what occurs in healthy persons and dogs under forced feeding. The excess of food forms dry tissues, and water is cast off to compensate for this, so that the weight may not increase in spite of the overfeeding. In the obese the dry tissues melt away and water is retained to compensate for this. So the weight keeps on a level in both conditions.

All this is altered, however, by removal of the thyroid or ovaries. In the thyroidectomized but otherwise normal ani-

mals, retention of water to an extreme degree follows and the weight increases rapidly and continuously. This and other facts cited demonstrate that the thyroid not only controls the intensity of the oxidations but also the intracellular water metabolism. The importance of the thyroid in the pathology and treatment of edema and obesity has been overlooked; the retention of water in the obese has been erroneously ascribed to cardiovascular weakness. This may develop secondary to the sluggish and abnormal water metabolism, and it calls for endocrine treatment, especially thyroid treatment. Two of the patients took for weeks thyroid extract three times a day, with a diet of only thirty per cent. of the normal requirement, and all with good effect and without appreciable subjective disturbances. Moderate exercise, such as a short walk, has generally a favorable effect, but it renders more difficult the oversight of the case.

He begins with reduction to fifty per cent. of the requirement, with a maximum of fifteen hundred cubic centimeters of fluid. The food should contain at least eight grams of nitrogen and be predominantly of carbohydrates and be salt-poor. A milk diet is often excellent, not allowing over one and one-half liters daily. If these measures fail, the food can be reduced to thirty-three or even twenty-five per cent. of the requirement, with only one thousand cubic centimeters of water, if there is nothing to hinder on the part of the circulation or subjective findings. A day of very little or no calory intake may be interposed. There is not much danger, he says, of appreciable losses of nitrogenous substances from the body with this, as in the overfed organism a large part of the albumin stored up in the obese tissues is quite different from living protoplasm albumin, and is by no means biologically on a par with it. Only when all these measures fail, does he supplement them with endocrine therapy.

Men are much less sensitive about their personal appearance than women and they do not hesitate to record and publish the history of their struggles to overcome a tendency to obesity. Recent books like Irvin Cobb's "One Third Off" are frank expositions of an awakening to the fact that the overload of fat is detrimental to comfort and positively dan-

gerous to existence. The realization of this danger and the determined and successful efforts to reduce weight are related by Cobb in a very readable book.

Women are reticent but, as we have shown, many of them are also quite determined to follow a plan if it appeals to their reason and especially if it is likely to improve their figure and spare them criticism. Women whose occupation brings them before the public go to unending effort to keep within bounds and one of the most famous of these wrote out what she found to be the successful solution of the problem.

The late Lillian Russell contributed a valuable summary of her system and it reveals the arduous road which the devotees of her art must follow if they would arrive at her state of physical perfection.

DIETETIC TREATMENT.

The food requirements will vary naturally with the weight and the energy expended in the daily occupation. Growing children will require thirty to forty calories per pound of body weight; adults (depending on activity), eighteen to twenty calories; and old people, fifteen or less calories per pound. A man at rest and of average size requires eighteen hundred to two thousand calories; while working at a sedentary occupation, twenty-two hundred calories; and at hard work, thirty-five hundred to four thousand calories per day. The relative figures for women are sixteen hundred to eighteen; two thousand to twenty-two hundred, and in very active occupation, twenty-two hundred to twenty-five hundred calories, or possibly three thousand (see Farr, Vol. I, page 12).

No system of diet can be properly carried out without recognizing the caloric values of foods, and this has received an extraordinary amount of attention in recent years. We have our nutrition laboratories and experimental feeding tests conducted by governmental and private institutions, from which emanate from time to time valuable data for the education of the public in this vital matter. During the recent war the food problem became acute and public sentiment was strongly opposed to waste and extravagance in

food. It was not patriotic to indulge in unnecessary food when the soldiers needed it and the slogan went forth that "food will win the war." It almost needed a war to make some realize the great amount of unnecessary food that most of us were taking. As the cost mounted, economy had to be practiced and the result was that less fat and sugar were used in the household.

We cannot present this subject in a more graphic and succinct manner than by repeating what Dr. Eugene L. Fisk,¹³ now of the Health Extension Institute, wrote some eight years ago.

In a colloquy between a Martian and the Cold Blooded Scientist, Martian says: "I have been observing the eating habits of your people and am amazed at the volume of food they consume. Is your food so innutritious that it must be taken in such bulk?

C. B. S.: No, most of our food, except some of the canned stuff, is nutritious. The quantity consumed is governed by *habit*, not by *necessity*. The average man eats enough meat to support a giant.

Martian: Is this just a *belief* on your part, or is there exact scientific evidence to support it?

C. B. S.: The *beliefs* in the matter are mostly held by those who advocate generous feeding. The old orthodox views on this question were based on curiously insufficient and unscientific data, *viz.*, observation of the *habits* rather than the *needs* of large groups of individuals.

C. B. S. then goes on to enlighten Martian on the calory and the researches of Atwater and Voit, whose standards were based upon the *average man's consumption of food*, claiming that from three thousand and fifty-five to thirty-five hundred calories and from one hundred and eighteen to one hundred and twenty-five grams of protein were required daily. He then shows his celestial visitor that man's health and endurance can be maintained and even improved on half that allowance. A man requires only sufficient food to repair the waste of tissue and to make good the heat lost by the body each day. Appetite and instinct, when an excess of appetizing food is available, usually lead to excess.

The over-nourished are blessed, or rather, cursed, with keen appetite. Mental ease and contentment, politeness, good fellowship, attractive and tempting dishes, mere habit—a multiplicity of influences aside from the body's needs—arouse *appetite* and govern our consumption of food.

C. B. S. instructs Martian, who is apparently ignorant, like some of the earthly mortals, of the relative value of protein and carbohydrate food. The protein is required for muscle building, organ building and bone building; it is found in lean meats, the white of eggs and in some vegetables and cereals, such as peas, beans, lentils, wheat, oats, and in milk. Very little protein is needed for repair purposes after maturity; but the fat building foods, such as butter, fat, oils, and cereals, and starchy vegetables furnish the reserve supply of possible fat. They are not so injurious, perhaps, as excess of protein, but used unstintingly they lead to corpulence.

The carbohydrates, like fat, can protect circulating albumin from katabolism and aid its transformation to organic albumin, but it is not proved that they themselves *make* fat as at first supposed, for they are very completely destroyed even when eaten in excess. They merely protect other foods from oxidation under such conditions. Meat and carbohydrates alone increase the fat in the body without the aid of fatty food; for fat, which originates from splitting up albumin, is spared further metabolism. Hence fatty metabolism in the body may be quite independent of fatty ingestion.

A gain in muscular efficiency should go hand in hand with loss of weight. Otherwise harm may result, nervousness, general weakness, especially of the heart, are to be feared if reducing measures are blindly persisted in. In order to prevent loss of body proteids suitable exercises should be instituted to strengthen a heart that has become weak from inactivity. It follows that rapid reductions of weight should not be undertaken unless some exercise can be given (Hewlett¹).

George Cheyne's thirteenth aphorism should be borne in mind. "Every wise man over *fifty* ought to begin to lessen at least the quantity of his *aliment*, and if he would continue free of great and dangerous distempers and preserve his senses and faculties clear to the last, he ought every seven

years to go on abating gradually and sensibly, and at last *descend* out of life as he ascended into it, even into the child's diet."

All life insurance experts know that the best risks at middle life are somewhat below the average weight, as we have shown.

The following shows the *caloric value* of articles of food commonly used for breakfast, luncheon and dinner, and with a total of 2729 calories. A departure from this total value can easily be made by omitting some of the articles:

Breakfast	Protein	Calories
One shredded wheat biscuit	3.15	106
One teacup of cream	3.12	206
One breakfast roll	5.07	165
Two one-inch cubes of butter	0.38	284
Three-fourths cup of coffee	0.26	...
One-fourth teacup of cream	0.78	51
One lump of sugar .....	....	38
	12.76	850
Lunch	Protein	Calories
One teacup homemade chicken soup	5.25	60
One luncheon roll	3.38	110
Two one-inch cubes of butter	0.38	284
One slice lean bacon	2.14	65
One small baked potato	1.53	55
One rice croquette	3.42	150
Two ounces maple syrup .....	....	166
One cup of tea with one slice of lemon .....	....	...
One lump of sugar .....	....	38
	16.10	928
Dinner	Protein	Calories
One teacup cream of corn soup	3.25	72
One luncheon roll	3.38	110
One-inch cube of butter	0.19	142
One small lamb chop, broiled	8.51	92
One teacup of mashed potato	3.34	175
Apple-celery lettuce salad with mayonnaise dressing .	0.62	75
One cracker	1.32	47
One-half inch cube American cheese	3.35	50
One-half teacup of bread pudding	5.25	150
One demi-tasse coffee .....	....	...
One lump of sugar .....	....	38
	29.21	951

Grand Total: Protein. 58.07, Calories 2729.

Although it is usual for hospitals and sanatoria to have a service of diet, it has remained for the leading hotel in New York to provide a set of specially arranged menus suitable for a number of affections for the use of their patrons who may require them under medical advice. In this instance the diet scheme has been arranged by a physician who has grouped the particular needs of patients under seven different classes.

Under diet No. 2,* which is designated as being of high cellulose, low calory, and low in fat, starch and sugar, is found the following list of items:

BREAKFAST.

Fruit (unsweetened).

Orange, apple (raw), grapes, baked apple, stewed pears, stewed prunes.

Cereals (with cream).

Shredded wheat, krumpled bran, cereal meal, cracked wheat.

Bread.

Bran muffins, bran bread, gluten bread (toasted), wheatsworth biscuit, whole wheat biscuit, casein bread (Lister's).

Eggs.

Boiled, poached, scrambled.

(or) Meat.

Broiled lean ham, broiled lamb chop, broiled mutton chop, broiled chicken, steak (lean).

(or) Fish.

Bluefish, striped bass, brook trout, codfish.

Beverages.

Tea (no cream or sugar), coffee, hot skimmed milk, kaffee hag.

LUNCHEON AND DINNER.

Relishes.

Radishes, olives, celery, pickles.

Soups

Vegetable (strained), bouillon, chicken broth, clam broth.

Fish

Blue fish, brook trout, lobster, codfish, striped bass, crab meat.

* The author is indebted to Mr. Carruthers of the Waldorf-Astoria for this menu.

Cold

Fish (as above), Meats (as below), Lean ham, tongue.

Meat

Broiled, boiled or roasted lean meat or chicken, any variety (plain) on general menu except liver, pork, goose and duck.

Vegetables (without butter or cream).

Asparagus, spinach, peas, string beans, mushrooms, tomatoes, cabbage, cauliflower, stewed celery, onions, sauerkraut, brussels sprouts, green peppers.

Salads

Grapefruit, Romaine, hearts of lettuce, celery, chicory, watercress, French endive, tomato, cold slaw. With lemon juice only or special Waldorf diet dressing.

Desserts

Pineapple (fresh), raw pear, raw apple, grapefruit, stewed pears (without sugar), baked apple (without sugar), ices (any flavor).

Beverages.

Tea, coffee, buttermilk, skimmed milk.

In connection with this menu there is this note: "Food quantity, food quality and the *will* to get thin are important factors in reducing. Obesity fads do tremendous harm. Weight reduction by following the straight and narrow paths of rational dieting and exercise, rather than the devious paths of drugs and 'isms, is the only safe course. A reducing cure should be supervised by your physician."

Reduction Cures for Surgical Purposes. It is occasionally deemed necessary to attempt a reduction cure before operating on the abdomen. The difficulties and dangers of abdominal operations in the obese are well known. Large abdominal scars are liable to hernia and their repair can be better accomplished if the superficial fat is removed by a course of dieting. It was such a case that Dr. J. H. Means⁷ had the opportunity of studying in the Massachusetts General Hospital, carrying out an experimental study of the metabolism to which we have previously referred. In this case the patient was reduced from two hundred and forty-five pounds to two hundred and eleven pounds in two and one-half months when she was operated on successfully. Three months later the patient weighed one hundred and eighty-five pounds and was in excellent health.

CLASS TREATMENT OF OVERWEIGHT.

In the spring of 1920 the Health Commissioner of Chicago, impressed with the fact that a great many good men and women are overweight, undertook to organize a physical culture and gardening club. He called for fifty volunteers—twenty-five men and twenty-five women, to embark on a sixty day course of weight reducing and health promotion. The women volunteers ranged in age from twenty to forty-five and all were engaged in sedentary occupations. But no men volunteered, as they evidently were not as much interested in improving their health status. The age, weight, height and occupation of each applicant were taken and records were kept, noting gain and loss of weight as well as general health conditions. This municipal experiment reflects great credit on the Health Department of Chicago. It included exercises and a course of dieting, accompanied by lectures and careful physical examinations. A set of menus was prepared by Miss Ruth Wilbur, dietitian of the Chicago Training School for Home and Public Nursing. These contain the food essential for those desiring to reduce their weight. We have taken the opportunity of reproducing them, as they contain a surprising variety of foods and successfully avoid a monotony of dishes, a very desirable feature in matters of diet.

Dr. Robertson, the Commissioner, recognizing that a course of physical exercises must go hand in hand with diet, made them a feature of the course. The exercise of walking, weeding or hoeing in the garden, was supplemented by a system of setting-up exercises which, it was emphasized, should be taken in the morning on rising, before dressing or eating and with all windows open. The exercises were as follows and it was noted that those who followed the system made the best progress in getting rid of surplus fat:

- (1) Feet together, stand erect, bend body forward slowly, touch fingers to floor without bending knees, six times.
- (2) Right foot forward, bend body in same way, touching fingers without bending right knee, six times.
- (3) Repeat same with left foot forward, six times.

(4) Stand at open window, inhale (take deep breath, hold it, drop chest), raise right arm above head, lower it, exhale (blow air out of lungs), six times.

(5) Repeat same with left arm.

(6) Repeat same with both arms.

(7) Inhale, drop chest, arms clasped straight forward, raise arms above head without bending elbows, bending head forward. (Do not put hands back of head, only above head.)

(8) Hands on hip, balance on ball of right foot, then left, alternately, changing weight, twelve times.

(9) Raise right leg sideways, six times; then left leg, six times.

(10) Place both feet firmly on floor, one foot apart, and stoop six times without assistance.

(11) Hands and feet on floor, animal fashion, kick out six times.

(12) Lie on back, clasp hands underneath knees, roll to sitting posture; repeat twelve times.

Menu prepared for the Chicago School of Sanitary Instruction.*

FIRST DAY.

Breakfast:

One-half grapefruit.

One slice bacon.

One slice toast or bran muffin.

One cup coffee with $1\frac{1}{2}$ tablespoons skim milk.

Note: If milk is heated for coffee, it will taste as good as cream.

Use no sugar.

Dinner:

Medium serving of any lean meat.

Salad—lettuce with sliced tomatoes, French dressing.

Green peas without butter or milk.

Rye bread with 1 teaspoonful of butter.

Sliced pineapple for dessert.

Black coffee.

Note: Avoid cream sauces or rich meat gravies.

Supper:

Tomato bouillon.

Two crackers.

Salad—lettuce with French dressing.

Bran bread without butter.

Fruit for dessert.

Black coffee.

* Bulletin Chicago School of Sanitary Instruction, June 26, 1920.

SECOND DAY.

Breakfast:

- One medium apple.
- One egg.
- One slice toast.
- One cup coffee with one and one-half tablespoons skim milk.

10.30 A.M.:

- One-half cup bouillon.
- One cracker.

Luncheon:

- Lean, cold roast beef, medium serving.
- Rye bread, two thin slices.
- Lettuce and cottage cheese salad.
- Lettuce—any amount.
- Cheese—two and one-half tablespoons.
- French dressing—one-half tablespoon.

4.30 P.M.:

- Tea with lemon.
- One cracker.

Dinner:

- Boiled cod with lemon (large serving).
- Cauliflower (plain) one large serving.
- One scant teaspoonful butter.
- Lettuce salad or celery (large serving).
- One-half of a large orange.
- Black coffee.

10.30 P.M.:

- One-half cup hot skim milk.

THIRD DAY.

Breakfast:

- Stewed prunes (ordinary serving).
- One egg on one slice toast, without butter.
- Bran muffins.
- Coffee with boiled skim milk, no sugar.

Luncheon:

- Asparagus on one slice toast, without butter.
- Lettuce salad—French dressing.
- Fruit for dessert.
- Coffee with boiled skim milk, no sugar.

Dinner:

- One serving of any lean meat.
- Spinach any amount.
- Salad—lettuce and cucumber with French dressing.
- Fruit gelatin, without cream or sugar.
- Tea or coffee, clear.

FOURTH DAY.

Breakfast:

- One apple.
- Two slices bacon.
- One slice any coarse bread with one teaspoon butter.
- Coffee with hot skim milk.

Luncheon:

- Clear soup with two crackers.
- Salad—lettuce with any cold vegetable, French dressing.
- Fruit for dessert.
- Clear coffee.

Dinner:

- One serving of any lean meat.*
- String beans.
- Graham bread with one teaspoon butter.
- Cabbage salad (shredded raw cabbage served with vinegar, salt and pepper).
- Stewed fruit for dessert.
- Tea or coffee.

FIFTH DAY.

Breakfast:

- One-half grapefruit without sugar.
- One egg on slice of unbuttered toast.
- Bran muffins.
- Coffee with heated skim milk.

Luncheon:

- Clear tomato soup with little rice, no crackers.
- Lettuce salad with French dressing—you may add chili sauce to salad if you like.
- Fruit.
- Coffee.

Dinner:

- One serving of any lean meat (perhaps corned beef, if lean).
- Cabbage (boiled) or sauerkraut. Best way to cook cabbage:
Shred it and boil for only fifteen minutes in little water. Add vinegar when serving, if you wish.
- Salad—lettuce with apple sliced, and a few raisins.
- Bran bread with one teaspoon butter.
- Fruit for dessert.
- Tea or coffee.

SIXTH DAY.

Breakfast:

- One orange.
- Asparagus on unbuttered toast.
- Bran muffins.
- Coffee with hot skim milk, no sugar.

* Pork not included.

Luncheon:

Clear soup.
 Two crackers.
 Lettuce salad with sliced tomatoes and cucumbers, French dressing.
 Bran bread.
 Fruit for dessert.
 Coffee.

Dinner:

One serving of broiled fish—halibut, perhaps—no salmon.
 Stewed tomatoes—any amount.
 Waldorf salad—lettuce with chopped apple and celery. French dressing.
 Sliced pineapple.
 Bran bread with one teaspoon butter.
 Tea or coffee.

NOTE: If you must have your coffee and fruit sweet, you may use saccharine or sweetena. Get it at any drug store. Use sparingly and follow directions, because it is much sweeter than sugar. It is not fattening.

If you are in the habit of eating more than is listed here, you will probably feel hungry between meals, especially if you are exercising. If this is so, you may take any clear soup or bouillon with a cracker between meals. A glass of water will often satisfy this hungry feeling. Meat once a day is enough. No potatoes.

FIRST WEEK.

Breakfast:

One soft boiled egg.
 Dish of tomatoes.
 Cup broth.
 One cup coffee, (no milk or sugar).

Dinner:

One soft boiled egg.
 Two ounces 5 per cent. vegetable.
 Two ounces 5 per cent. vegetable.
 One cup broth, (no milk, sugar or salt).

Supper:

One soft boiled egg.
 One dish 5 per cent. vegetable.
 One dish 5 per cent. vegetable.
 One cup broth.

SECOND WEEK.

Breakfast:

One soft boiled egg.
 One dish of tomatoes.
 Dish of vegetables.
 One cup broth.
 One graham gem, no butter.

Dinner:

Two ounces meat or fish.
Three ounces 5 per cent vegetable.
Three ounces 5 per cent vegetable.
One cup broth.
One soft boiled egg.

Supper:

Two ounces meat, lean.
One egg.
Three ounces 5 per cent. vegetable.
Three ounces 5 per cent. vegetable.
One graham gem.

THIRD WEEK.

Breakfast:

Two eggs.
Six ounces broth.
Four ounces 5 per cent. vegetable.
One slice bread.

Dinner:

One-sixth ounce butter.
Two ounces meat.
Three ounces 5 per cent. vegetable.
Six ounces broth.
Two ounces 5 per cent. vegetable.
One slice bread.

Supper:

One-sixth ounce butter.
One ounce meat.
One egg.
Three ounces 5 per cent. vegetable.
One slice bread.

FOURTH WEEK.

Breakfast:

Three ounces cream.
One-third ounce butter.
Two eggs.
Three ounces 5 per cent. vegetable.
One-half cup of oat flake.
One slice bread.

Dinner:

One-third ounce butter.
Two ounces meat.
Three ounces 10 per cent vegetable.
Five ounces broth.
One slice bread.
Two ounces 5 per cent. vegetable.

Supper:

One-third ounce butter.
 One slice of bread.
 Two ounces meat.
 One egg.
 Three ounces 5 per cent. vegetable.
 Two ounces 10 per cent. vegetable.
 One slice bread.

5 per cent. vegetables.

Lettuce.
 Celery.
 Endive.
 Spinach.
 Sauerkraut.
 String beans.
 Radishes.

Asparagus.
 Chard.
 Cauliflower.
 Cabbage.
 Tomato.
 Eggplant.

10 per cent. vegetables.

Onions.
 Squash.
 Turnips.
 Carrots.
 Beets.
 Parsnips.

LOW CALORY DIET.

Breakfast:

One slice of very dry, coarse, bread toast $\frac{1}{4}$ inch thick	50
Butter $\frac{1}{4}$ cubic inch	25
Hot water flavored with coffee	00
	<hr/>
	75

Luncheon:

One corn muffin	125
One pat of butter	100
Salad, Roquefort cheese dressing	100
One cup of coffee with a tablespoonful of cream	50
	<hr/>
	375

Dinner:

Vegetable soup or bouillon, no fat	25
Lean meat or lobster, or fish, 5 or 6 ounces	300
Large serving of uncooked lettuce or cabbage	00
Mayonnaise or oil, teaspoonful	50
One large dish of tomatoes or cauliflower, or string beans or carrots or turnips	25
One slice of bread, medium, or one medium potato	100
One pat of butter	100
Dessert, two macaroons or lady fingers	100
One cup of cereal-coffee, water	00
	<hr/>
	700

Total1150

Another attempt to treat overweight on a large scale was made by Dr. Royal S. Copeland, Health Commissioner of New York City, in October and November, 1921. It has

attracted wide-spread interest and, as in Chicago, women have been most interested and have formed the larger part of the class taking treatment. As a spectacular undertaking it has been a great success. It was designed primarily to attract attention to the Health Exposition held in New York in November, but quickly demonstrated that there were thousands in New York who are honestly anxious to get rid of superfluous flesh.

At the close of the thirty day contest, November thirteenth, prizes were awarded. The winner of the first prize was thirty-two years old, and five feet, seven and three-quarters inches tall. Her bust measurement was 52 inches and fell to 47.5 inches. Her waist was 50 inches and at the end of the test, 39 inches. Her hips were reduced from 60 inches to 53 inches. Her weight at the start was 281 pounds; at the finish, 250 pounds.

The second prize went to a lady thirty-three years old; five feet, eight inches tall; who was reduced from 258 pounds to 229.5 pounds. The third, aged twenty-four, and five feet, four and one-half inches tall, dropped from 194 pounds to 168 pounds. Thirty-four persons lost an average of 16.5 pounds.

The Health Commissioner states that the demonstration has shown several interesting things. "Hunger, a perfectly natural symptom, is satisfied in a wrong way by very many persons. When the stomach is empty it communicates with the brain and a call for food is sounded. Likely a drink of water would satisfy this yearning but instead of taking water a quantity of chocolate candy, or ice cream, half a pound of sweet grapes, a handful of raisins, dates, figs, or other similar articles, is taken. These but add to the fuel.

"The greatest mistake people make is in the selection of their food. The average meal is poorly balanced. This is particularly so of breakfast. Imagine wanting to get thin on a breakfast like this: Cereal and cream, hot muffins with butter and honey, sausage, and possibly some fruit covered with sugar. This entire meal is made up of starches and sugar, which add to the flesh, and very often as an added offense it is washed down with tea, coffee or cocoa saturated with sugar.

"There is no secret in a system of fat reducing. No system can succeed unless the candidate for a sylphlike form has instructed herself in food values and is willing to 'carry forward' until the end is accomplished. It is easier to say what foods ought not to be eaten than to set down those that are safe to take. There are certain foods that may be taken abundantly. Some of them are celery, buttermilk, radishes, endive, lettuce, tomatoes, watercress, clams, whites of eggs, chicken without the skin, shad, white meat of lobster, codfish, pears, apples, grapefruit, lemons, oranges, rhubarb, lean meat and skimmed milk.

"Don't forget in reducing flesh exercise is important. One cannot expect to get thin when all the exercise taken in a day consists principally of getting on and off cars. Let me repeat again that all these things may be done with good result, but if a person goes back to the old method of eating it will all have been done in vain."

Susannah Cocroft of Chicago, is a lady who is widely known as an exponent of physical culture and has helped many thousand men as well as women to a better physique by the rational application of the methods enumerated. Miss Cocroft undertook the training of a large number of women employed in Government service in Washington during the war, rendering in this way a patriotic service.

CIRCULATORY DISORDERS IN THE OBESE.

The order in which these occur is somewhat as follows: Dilatation is liable to occur first in consequence of the fatty deposits; afterward, when compensation for the damaged heart muscle is impossible, the symptoms of muscular insufficiency supervene. In case of arterial disturbances sufficient to cause effusions of blood to the brain, the outlook is very serious and its occurrence is a common cause of death in the obese. They also readily succumb to any infectious disease that attacks them.

Whenever cardiac dilatation, valvular lesions, myocarditis, fatty heart, or other degenerative changes in the heart muscle are noted, much care should be used in giving advice and treatment. Removal of an extra burden will naturally favor a weak heart and check a tendency to hypertrophy and

dilatation. Heart affections of this type may be benefited by the reduction cure. But in advanced arteriosclerosis, or in such cases as are suspected to have any aneurism, naturally much harm might be done. Active muscular exercise would not be warranted, but rather, passive exercises. The so-called resistance exercises, under skillful guidance, will be a suitable measure.

Many probably fear that a reduction cure will take away strength along with the fat. Overexercise and underfeeding may readily do this, especially if purgatives and organic drugs are given at the same time. The aim should be to enhance muscular power while fat is lost. The muscles should be rescued from inertia and indolence by affording a fresher circulation and an increased muscular tone.

The skin is the greatest organ of the body and it is, of all the organs, the one most intimately associated with the fat; hence it is reasonable to suppose that massage and a course of baths in which the skin is made to yield profuse perspiration, especially when we follow these measures with a hot-blanket pack, will give good results.

The mechanical effects of increased abdominal and intra-thoracic fat are exerted on the lungs; the breathing space is encroached upon, the respiratory capacity is lessened. Dr. James M. Anders¹⁴ has observed that the respiratory expansive movement of the lungs, as measured outside the chest, is often less than 2.5 inches and hence muscular exercise usually causes dyspnea when such fatty deposits are present. It is obvious that the coexistence of a very full stomach and much surrounding fat will cause interference with respiration.

In the anemic form of obesity there is small capacity for exercise; the fat globules are more loosely grouped, together with greater abundance of intervening material in the form of seromucous fluid, which greatly interferes with muscular action. In the plethoric form of obesity the dyspnea is much less and the general bodily vigor is not lessened, but is often about the standard.

In these cases of overfatness Dr. Anders¹⁴ has noted a peculiar pain in the subscapular and intrascapular muscles extending across the back from side to side and giving the sensation "as though the flesh had grown fast to the bones."

"Mere obesity or subpericardial fatness does not imply fatty infiltration but it may, in a mechanical manner, produce respiratory and circulatory disturbances, particularly venous stasis, as shown by cyanosis, a frequent, small pulse and dyspnea; or a distinctly asthmatic form of breathing and sometimes cough."

MECHANICAL AND ELECTRIC DEVICES.

Mechanical-electrical devices have been used in recent years for weight reduction. In 1909 Bergonie, of Bordeaux, described results of his system of passive ergotherapy by means of a coarse wire Faradic apparatus. This is provided with a metronome with variable time control and quicksilver contacts, a current controller, a series of circuit controllers, and a chair with both stationary and movable electrodes. In one form of apparatus there are four large metallic electrodes: two for the abdomen, to be placed on either side of the median line, and two for the anterior portions of the thighs. In another form there are twelve electrodes: six stationary (for the back, buttocks and thighs, and legs) and six movable (two for the arms, two for the abdomen, and two for the thighs). Provision is made for contact in from two to ten different parts of the body, so that different parts may be stimulated simultaneously to powerful but comparatively painless contractions. The current is rhythmically interrupted and reversed and timed to correspond with the action of the heart. The interrupter, or vibrator, is made to operate at thirty per second, the rate of normal muscle fibrillation; the gross muscular contractions are regulated during treatment by the metronome according to the changing heart beat.

In Titus's method the chair is covered with a moderately thin bibulous material wet with warm water, and the movable electrodes are slipped in suitable sized covers like a pillow slip, also wet and of the same thickness of material. It is necessary that the covering material of all electrodes should be of the same thickness, as the tension of the current from the machine to the patient being only twenty-four volts the slightest difference in this detail will make the current irregular and quite unsatisfactory in its effects; not over

fifty to seventy-five milliamperes are required. The total area of the electrodes may amount to ten thousand square centimeters. Titus holds the arm electrodes in place by crepe bandages because they are elastic; those on the thighs and abdomen are best secured by sand bags. By their weight they secure a good contact and give the muscles a little more work to do. Titus describes the technique quite fully as to the preparation of the patient, who, besides wearing his shoes and stockings, is covered with a sheet; as to the testing of the mechanism; the duration of the seance and the general period of treatment. He advocates a treatment daily for the first three or four weeks; then on alternate days for a similar period. Associated with this is a special diet of small caloric value and liberal doses of a saline laxative water morning and night. The results are apparently satisfactory.

Morse wave generators used to produce muscle stimulation, may be attached to a type of Bergonie chair for a similar plan of treatment. The suggestion has been made to have the chair fitted with a series of incandescent lamps underneath, as already tried successfully at the Walter Reed General Hospital in Washington. The Morse wave affords a slow expansion and contraction resulting in a possibly fuller action; but unless it is adjusted with proper rheostats for different degrees of current for the various parts of the body, it is painful, a condition said never to be met with in using the Bergonie method. Titus has criticised these other methods, saying that they have been followed by exhaustion physical and mental, with changes in the urinary content (which indicated irritation), such as large quantities of urea, sometimes sugar and frequently albumen and casts. Hence, caution in advice as to electromechanical treatment.

There are several very useful effects. In the first place, muscular contractions tend to an increase in the size of the muscle and a loss of fat. One may balance the other for a time but ultimately the loss of fat is greater. This shows itself—at first in a better bodily contour, and later by an appreciable loss in body weight with better elimination of the products of tissue waste. It is claimed that deep respiratory excursions are involuntarily induced and a greater activity of both skin and kidney function is likewise observed.

Patients who seldom perspire will develop most active diaphoresis and diuresis, and it is not uncommon to have them void from twelve to sixteen ounces of urine which is both physically and chemically normal at the end of an hour's treatment.

Franz Nagelschmidt, of Berlin, modified Bergonie's apparatus so as to give greater energy, as claimed by those favoring this type. It has been advertised energetically as a cure for obesity, without pain, without dietetic restrictions, and of course with lasting results.

No patients should be subjected at the beginning to a full hour's treatment with maximum energy; beginning with fifteen-minute sessions, sixty minutes may be attained gradually. Nagelschmidt administered treatment in two series: at first a series of twenty-five sessions covering four weeks; then an intermission of from one to four weeks; and then a series of the same length. He added that if necessary the treatment should be repeated.

We can readily see that the exercise with any form of apparatus producing sixty contractions per minute is represented by thirty-six hundred contractions per hour for each electrode used—no small expenditure of physical energy.

Voluntary physical exercise, of course, involves likewise a large number of muscular contractions, but few of those who need it most can voluntarily make a corresponding degree of effort.

The well known system of mechanical exercises invented by the late Prof. Gustaf Zander, of Sweden, is a combination of both active and passive movements by means of apparatus of great ingenuity and adapted for every part of the body. This apparatus is found in "Zander Institutions" in European resorts and in a few places in the United States. Some passenger steamers are also equipped with a few of the simpler pieces. The first installation in America was made at the Massachusetts General Hospital in 1905 and it is there that the most systematic and intelligent use of the system has been made in America. The hospital has one hundred pieces of apparatus. They are in part active, or depending on the voluntary effort of the patient; and in part passive, or electrically operated. In the larger sets, as those in Boston and

at the Virginia Hot Springs, one can choose special forms and arrange the time allotted to each form or group of apparatus so as to judiciously enhance muscular power and incidentally reduce the undesirable superficial fat. A trained attendant and medical supervision are naturally required to carry out this plan of treatment successfully. There are over fifty pieces and they are quite expensive to install, as they must be imported.

EXERCISE.

Active exercises in the open air are desirable if the physical condition warrants and the environment permits. A great change, however, has come over us in this regard during the last few years. Walking exercises, in our cities at least, are not carried out so easily or so safely as formerly. The patient who most needs the exercise usually has his car and uses it on all possible occasions. It may be thought quicker, easier or safer than to walk through the streets. Outside of the cities the pedestrian has a sorry time of it if he presumes to walk upon a popular highway these days. Not unfrequently pride will prevent the adoption of such a prescription and hence the exercise must be taken in secret.

We ought to give to our obese friends the prescription which was handed to his customers by an old English boot-maker nearly one hundred years ago.

"The best medicine: Two miles of oxygen three times a day. This is not only the best but cheap and pleasant to take. It suits all ages and constitutions. It cures cold feet, hot heads, pale faces, feeble lungs and bad tempers. If two or three take it together it has a still more striking effect. This medicine never fails. Spurious compounds are found in large towns; but get into the country lanes among green fields, or on the mountain top and you have it in perfection as prepared in the great laboratory of nature."

Horseback exercise belongs for the most part to a bygone age. There are, to be sure, a few resorts where saddle horses may be had and where there are suitable roads; and there are bridle paths in most of our parks; but the horse and the rider are surely vanishing. More than that, a very fat man or woman does not look well on horseback. In Mr. Dooley's

essay on Banting, which might be called in the elder style "A Vindication of Corpulence," he says that: "Nowadays 'tis the fashion to thry to emaciate ye'ersilf." Speaking of his friend Carney, he said: "then he thried takin' long walks. The long walk rayjooiced him half a pound and gave him a thirst that made him take on four pounds of Boodweiser. Thin he rinted a horse an' thried horseback ridin'. The horse liked his weight no more than Carney did an' Carney gained tin pounds in the hospital."

The skeptical Dooley gives this comfort to the corpulent: "If Nature intinded ye to be a little roly poly, a little roly poly ye'll be. They aint annything to do that ye ought to do that'll make ye thin and keep ye thin. Th' wan thing in the worruld that'll rayjooce ye surely is lack of sleep an' who wants to lose his mind with his flesh? I'll guarantee, with the aid of an alarm clock to make anny man a livin' skiliton in thirty days. The only ginooine anti-fat threatment is sickness, worry, throuble and insomnya."

HYDROTHERAPY.

Hydrotherapy is used for the reduction of weight with more or less success in connection with systematic exercise and dieting. In itself it is not sufficient.

There is a type of the overfat, high-living man who has eaten and drunk without very serious effects, and who periodically takes some form of reduction cure in order to keep his weight down and, incidentally, enjoy life once more in his accustomed way. Patients of this type are likely to have dilated stomachs and sluggish livers. They probably have learned to use laxative mineral waters or salts and in that way obviate any serious illness.

Besides a dilated stomach, careful examination will sometimes reveal a dilated or fatty heart, a slightly dusky look, yellowish conjunctiva, a quick pulse and a tendency to dyspnea. Hydrotherapeutic measures should therefore be carefully instituted and if possible, the patient should be seen shortly after his first bath.

The visitors at spas generally include cases of this kind and they demand suitable treatment. It should be based always on individual requirements and capabilities. Most

of these subjects are in middle life, are of sedentary habit and consequent muscular weakness. The heart should be observed at the start and all through the course of treatment. If baths are ordered, a daily record should be kept of weight and also of the heart's action. From time to time the blood-pressure should be recorded. Few go to hospitals for the reduction of weight but many go to spas. The further they

CHART I.

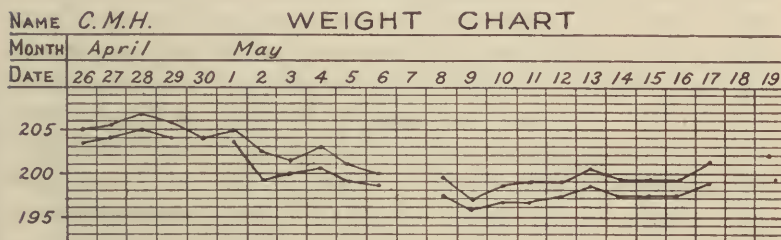
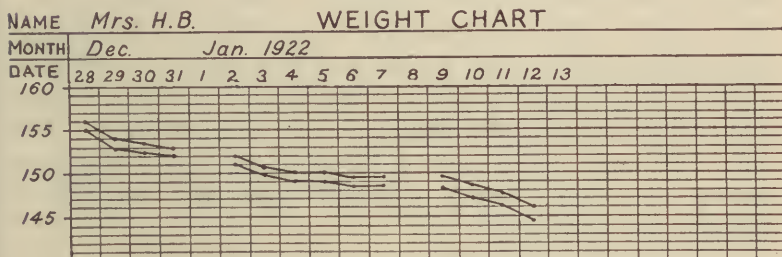


CHART II.



Upper line weight before the bath, and lower line after the bath.

go and the more sacrifices they make to undergo the cure, the more conscientious they are in adhering to discipline.

Men hear a great deal about the "boiling-out" process in use at certain springs. They are impressed with the advantage of extreme measures, and are usually anxious to lose a great deal of flesh in a minimum of time. If they go to a resort, they expect to dispense, more or less, with alcohol, and to limit their dietary. It is remarkable how much weight is lost in a single bath, when careful weighing is made before and afterward. The author has known a patient to lose five pounds in a single bath and a subsequent hot pack.

A patient has stated that he lost seven pounds in a single bath and pack. The accompanying charts illustrate the loss of weight while bathing, exercising, and dieting. The weight was taken without clothing before entering the bath, and on being dried after the final cold douche.

The régime in Case I allowed two meals a day; walking seven miles; swimming half an hour; a bath consisting in a warm douche for six minutes to the entire body, the water 104° F., and the temperature of the room about 100°; a tub-bath at 104° for twenty minutes, followed by a hot pack with eight blankets for twenty-five minutes. After this, the patient got into a tubful of water at 54° to 60° F. When he came out, he was dried and was ready to rest for an hour. This rather strenuous régime is suitable only for a man in perfect health and of perfect habits, to whom the term "patient" seems wholly inappropriate. The chart shows that in Case I, as much as three pounds was lost in a single bath, and as much as four and one-half pounds was gained in twenty-four hours as the result of breaking the dietary régime.

In another case the conditions were somewhat different. While accustomed to take a good deal of exercise, there was a decided alcohol habit, greater indulgence at the table, a very slight albuminuria, and a sluggish and overloaded liver. The patient was inclined to break through the régime, but, nevertheless, lost ten pounds in a month. The bath adopted by this patient consisted of:

Hot douche 104° F. (40° C.), for ten minutes.

Full bath 104° F. (40° C.), for ten minutes.

Hot, dry blanket pack, for twenty minutes.

Cold douche 50° F. (10° C.), followed by alcohol rub.

In the case of a third patient, weighing two hundred and fifty-one pounds, decidedly alcoholic, twenty pounds were lost in twenty-two days. The bath consisted of a warm douche for ten minutes, tub for fifteen minutes at 104° F., and a hot blanket-pack, using six blankets. The author has not found the hot-air cabinet followed by circular, jet, Scotch and fan douches, so effective as full baths and packs in the reduction of weight. Even when the cabinet is used for fifteen or twenty minutes at temperatures above 170° F.,

there is not the same tendency to lose flesh. The following formula is sometimes used in this plan of treatment:

H. A. B., or electric-light cabinet, up to twenty minutes.

C. D., 105° down to 70°, two minutes, twenty to thirty pounds.

J. D., 100° down to 70°, one minute, twenty to thirty pounds.

S. D., 105° and 70°, twenty seconds, twenty to thirty pounds.

Fan D., 65°, ten seconds, twenty to thirty pounds.

Alcohol rub. Reduce minima, 1° daily to 60°.

Certain European spas have acquired a great reputation for the treatment of obesity. Marienbad, Germany, and Carlsbad, Czechoslovakia, have been specially prominent in this respect and great favorites with American and English travelers. They are better suited to the plethoric cases rather than for the anemic types of obesity, or those presenting serious cardiovascular disease. Vichy and Brides-les-Bains are the spas of choice in France.

In America specialization of spas is not so definite as in Europe. A régime adapted to the needs of the obese is available at the Hot Springs, Virginia, and the White Sulphur Springs, West Virginia, and also at French Lick, Indiana, and Glen Springs, New York. The tendency at American spas is to treat all patients presenting themselves and it is likely that the methods adopted by individual physicians practicing at spas will vary greatly, even in reference to the same class of cases. One may emphasize the use of baths and exercises, and passive exercise by massage; another may institute some form of electrical treatment; others use thyroid extract in cases deemed suitable.

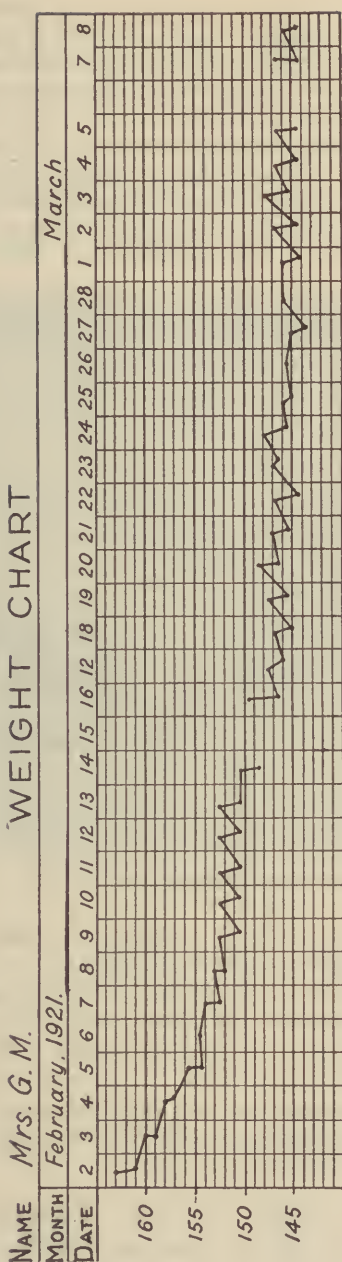
The results obtained at spas, while strikingly successful in many cases, have been held to be "rarely permanent unless the patient can be enjoined to continue certain details of treatment afterward." This criticism can be fairly made in discussing the results of treatment in any of the so-called diseases of metabolism. It is equally applicable in cases of gout and rheumatism, diabetes, diseases of the intestinal tract, or nephritis.

When bodily disorders are once corrected, or even partially corrected, we fall short of our duty if we neglect to stress the rules of life that must govern the patient who passes from observation. I think that the average visitor

to an American spa who once realizes the benefit derived from his visit, makes a decided effort to profit by his experience, and the repeated visits of these patients bear witness to the success of treatment. I have known a lady to return on ten successive years in a determined effort to check a strong tendency to acquire too much flesh. The weight and diet records of this case afford a good example of a persistent endeavor to reduce weight and are here appended.

- February
2. Sixteen ounces water, twelve ounces milk.
 3. Sixteen ounces water, twelve ounces milk.
 4. Thirty-two ounces water, twelve ounces milk.
 5. Twenty-four ounces water, twelve ounces milk.
 6. Twenty-four ounces water, twelve ounces milk.
 7. Thirty-two ounces water, eight ounces milk, one piece Melba toast, two cups clam broth.
 8. Forty-eight ounces water, four ounces milk, spinach, one piece pulled bread.
 9. Thirty-two ounces water, four oranges, one piece pulled bread, two cups chicken broth.
 10. Thirty-two ounces water, four oranges, one and one-half lemons, one piece Melba toast.
 11. Forty ounces water, one-half lemon, one piece Melba toast, one baked potato.
 12. Forty ounces water, four oranges, spinach.
 13. Twenty-four ounces water, sixteen ounces milk.
 14. Eight ounces water, eight ounces milk.
 15. Sixteen ounces water, sixteen ounces milk.
 16. Thirty-two ounces water, four oranges, one piece pulled bread, spinach.
 17. Forty ounces water, four oranges, one piece pulled bread, spinach.
 18. Forty-eight ounces water, twelve ounces milk.
 19. Thirty-eight ounces water, twelve ounces milk.
 20. Sixteen ounces water, six ounces milk, one piece pulled bread.
 21. Twenty-four ounces water, two oranges. 12.45 P.M., one piece pulled bread; spinach. 6 P.M., Melba toast.
 22. Forty ounces water. 9.15 A.M., one orange. 1 P.M., one piece pulled bread; spinach. 5.30 P.M., tea.
 23. 9 A.M., magnesia water and Vichy. 12.30, magnesia and Vichy. 1 P.M., Melba toast; spinach. 4 P.M., Melba toast. 6 P.M., tea with half a lemon.
 24. 9 A.M., magnesia and Vichy. 12.30 P.M., two oranges; pulled breads. 4.30 P.M., magnesia water and Vichy. 5.30, tea. 8.30, magnesia water and Vichy; one glass of water.
 25. 9 A.M., magnesia water and Vichy. 9.30 A.M., two pieces of Melba toast. 12.15 P.M., magnesia and Vichy water. 1 P.M., beefsteak; one piece pulled bread. 4.30 P.M., one orange. 9 P.M., one orange.

WEIGHT CHART



Weight chart of patient whose diet is detailed on pages 790 and 792.

26. 7.30 tea. 9 A.M., one orange. 12.30, magnesia and Vichy. 1 P.M., chicken, creamed carrots; pulled bread. 5 P.M., tea. 6.30 P.M., magnesia and Vichy water. 7.30, two pieces roast beef. 11 P.M., magnesia water. Two glasses plain water in the day.
27. 9.30, magnesia and Vichy water. 12.30, magnesia and Vichy water. 1.45, cold chicken; tongue; lettuce; egg; Melba toast. 5, tea. 6.30, cold chicken; tongue; Melba toast.
28. 11.30, magnesia and Vichy water. 1.30, roast beef; turnips, spinach. 5 P.M., magnesia and Vichy. 7.30 stewed



After Rowlandson.

tomatoes. 11 P.M., magnesia and Vichy; one orange. Two glasses of water in the day.

March 1. 12.30,, corned beef; Melba toast. 4 P.M., carbonated water. 5.30, magnesia and Vichy water. 7.30, roast chicken; Melba toast. 11 P.M., magnesia and Vichy. Three glasses of water in the day.

A similar diet was continued for three additional weeks and the weight remained, with slight variations, at 146.5 pounds. The general health and energy seemed to be unimpaired.

Loss of Weight by Baths and Severe Exercise. A man of fifty-two years, accustomed to intense activities, physical and mental, a repeated visitor at Hot Springs, Virginia.

March 5th, 1921	189 pounds
After bath at 5.30 P.M.	187.5 pounds
March 6th, hard tennis and golf	
Weight after bath	181. pounds
March 7th, hard tennis before bath	183. pounds
After bath	180.5 pounds
March 8th, after bath	182.5 pounds
March 11th, after bath	182. pounds

The loss was due to bathing and exercise and not to diet.

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Diseases of the Skin

BY

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Diseases of the Skin.

FOREWORD.

THE Section on Diseases of the Skin, of the present volume, has been written with the thought in view that this is a textbook on general medicine. Under these circumstances, only those dermatological conditions have been mentioned which have some relationship to the general economy.

The outbreaks or abnormalities described, occasionally or usually appear between puberty and forty years of age. The large group of cutaneous affections caused by vegetable organisms and animal parasites, external irritants, etc., has been excluded because they are exclusively of external origin and have no relationship to internal conditions. Those outbreaks distinctly of infancy and childhood, and others occurring after the age of forty years, have likewise been excluded. Among the former might be mentioned the eruptions caused by a congenital defect, such as nevi, ichthyosis, epidermolysis bullosa, and those of inheritance, such as hereditary syphilis. That so frequently occurring disease, epithelioma, has not been described, as it develops beyond the age scope of the present work.

TOXIC ERYTHEMA.

Toxic erythema is a congestion of the skin, consisting of variously sized patches of a reddish or pinkish color and of a localized or general distribution.

The characteristic feature of the disease is the redness, which exhibits no infiltration or elevation. The color can be entirely eliminated by pressure, but recurs immediately upon withdrawing the same. The congestion in most cases is of a limited distribution. The skin of the affected area is unusually hot, and there is generally mild itching and burning.

An outbreak of a rather localized distribution is usually due to external irritation, while those more or less generalized are of internal causation.

The widely distributed erythemas are usually caused by internal toxemic conditions, visceral and nervous disturbances.

ERYTHEMA MULTIFORME.

Erythema multiforme is an acute inflammatory disease characterized by the formation of macules, papules, tubercles, and at times vesicles and bullæ, which may be scattered or tend to group.

The disease may be ushered in with mild malaise, pains, and slight fever. Osler has recorded cases of this affection with visceral involvement or complications of considerable severity, some with abdominal crises simulating appendicitis. In the great majority of cases the affection starts with an acute outbreak of the eruption and mild, or an absence of, constitutional or subjective symptoms.

The eruption is usually observed upon the dorsal surface of the hands and lower portion of the forearms, the tibial aspect of the legs, and the face or neck. The palms and the soles in certain instances show extensive involvement. The outbreak is almost invariably of a symmetrical distribution. The lesions may be generally distributed in extensive cases. Exceptionally the mucous membranes of the mouth, the throat, the lips, the tongue, the eyelids, and the nose, may be attacked. The eruption usually consists of but one moderate or extensive outbreak, or new efflorescences may continue to appear over a period of from five to ten days. There is a great tendency for the condition to recur. The lesions are usually of a bright pink or red color.

The most frequently observed type of outbreak consists of papules of a flat character, which are small to large pea in size. A larger and deeper-seated type may be present, some of the latter resembling the lesions found in erythema nodosum. The lesions may take the form of macules, which tend to group in the form of rings. Patches of erythema may be present which exhibit sharply defined borders and only a faint redness of the center. Coalescence of several

rings may occur and patches of a gyrated appearance are observed. In addition to the usual type of eruption, an outbreak may consist of vesicles or of bullæ. There is usually one predominant type of lesion present, although other varieties may be observed.

The form known as erythema or herpes iris consists of concentric rings of vesicles or blebs of a variegated color, such as red, violet, and purple. The disease usually runs a course of a few days to a few weeks.

The exact cause of the affection is unknown, but it is probably of toxemic origin, either due to some intestinal toxin or of a bacterial nature. The disease has been attributed to the eating of stale articles of food, particularly the various sea foods. A considerable number of the milder attacks certainly seem to be of gastrointestinal origin. The severe cases have been attributed to various microorganisms, but none have been proved as causal. The outbreak may be associated with rheumatic pains and swellings of the joints. Antitoxin and various drugs, such as quinin, arsenic, belladonna, salicylic acid, potassium iodid, copaiba, some of the coal-tar group, and others, have been causative of an outbreak of multiform erythema.

It is more often observed during the spring and autumn months. Early adult life is more frequently attacked, particularly in females. Newly arrived immigrants are more prone to an attack, or those who change their residence from the country to the city. Other factors which have been mentioned as causal are urethral irritation, uterine disturbances, and a neurotic disposition.

Erythema multiforme is an acute condition running a course usually of from a few days to four or six weeks. The disease tends to relapse in a considerable proportion of cases, usually recurring each spring, each autumn, or in certain instances both spring and autumn.

ERYTHEMA NODOSUM.

Erythema nodosum is an acute inflammatory disease of the skin characterized by the development of node-like swellings over the anterior surface of the lower legs.

The disease may begin with fever, pains, and swelling of the joints, some gastric disturbance, and malaise. The eruption usually appears suddenly, and in the majority of cases is limited to the tibial aspect of the legs.

The eruption consists of from half a dozen to twenty or thirty nodes, which enlarge and become elevated, from a cherry to a hen's egg and larger in size. They are not sharply margined, but fade off more or less into the sound skin. The color varies from a pinkish to a bright red in the beginning, and in the course of a few days they undergo all the different hues of a bruise: reddish-blue, bluish, violet, dark brown, greenish, yellowish, and almost black in color. They have a tense and at times somewhat glistening appearance and are very tender to the touch and extremely painful. They are quite hard in the beginning, but soften after two or three days or longer, and fluctuation is present as if suppuration is about to occur, but absorption occurs without a break in the surface. The outbreak is usually symmetrical. The disease runs a course of a few days to a week or more. There may be but one crop of lesions or others may sometimes appear, lasting over the course of a few days.

The disease occurs usually in childhood or early adult life, most frequently under the age of thirty. It attacks females three to five times as frequently as males. It is probably caused by some toxin of a nature at present unknown. It has been observed in the course of syphilis, tuberculosis, glandular fever, diphtheria, malaria, and has occurred in individuals with gastrointestinal derangement. Certain drugs, such as antipyrin and the iodides, have apparently produced an outbreak in a few instances. Endocarditis has been a determining factor in a few cases. The disease usually runs an acute course, lasting for a few days, a week, or slightly longer.

URTICARIA.

Urticaria is an inflammatory disease of the skin characterized by the development of whitish, pinkish, or reddish elevations of a transient character, which are accompanied by itching, stinging, and burning.

The eruption in most cases appears suddenly, with or without preceding burning or tingling. There may be symptoms of gastrointestinal derangement, nausea, possibly vomiting, a coated tongue, loss of appetite, malaise, and headache, either accompanying the outbreak or preceding it by a few hours, a day, or more.

The outbreak may involve the entire cutaneous surface, or certain portions of the integument exhibit a profuse eruption. The efflorescence may be observed on one part of the body, lasting from a few minutes to an hour or two, and then may appear on another portion. No part of the surface is immune to an outbreak.

The wheals differ greatly in size, varying from a split pea to an egg, occasionally being so grouped that large areas are covered, with no normal skin intervening. The lesions are of a transient character, frequently vanishing within a few minutes after their appearance. The skin is extremely irritable in most cases, and slight irritation such as rubbing or scratching may produce fresh wheals.

The subjective symptoms of burning, itching, tickling, crawling, prickling, and stinging, are frequently distressing and the patient, because of scratching and rubbing, aggravates the irritability of the skin and causes an increased wheal formation. There may be a considerable amount of swelling and edema of the affected parts, particularly the hands, the feet, and the face.

The mucous membranes of the mouth, the throat, the larynx, and the intestinal tract, are at times attacked by wheals. Occasionally alarming symptoms are produced by the edematous swelling of the throat.

Urticaria may occur at any age and in both sexes; most cases, however, are observed in early adult life and in childhood. The female sex shows a greater tendency to an outbreak. In certain instances there seems to be a hereditary predisposition to an outbreak. The articles which are prone to cause wheal formation are the various sea foods, such as oysters, clams, crabs, lobsters, shrimps, mussels, fish; pork, sausage, scrapple, veal, nuts, mushrooms, strawberries, cucumbers, and the various canned foods. Certain individuals are unable to properly digest oatmeal, butter, potatoes, and

even eggs. Changes in environment and mode of living and eating not infrequently are causative factors in an outbreak, as particularly evinced by immigrants.

Any cause that produces digestive disorders or an incomplete digestion of the ingested food may become the determining factor in an outbreak. Emotional or psychic phenomena, such as fright, anger, shock, have been mentioned as causative. Outbreaks have been observed in association with various diseases, such as malaria, jaundice, albuminuria, diabetes mellitus, and also in the rheumatic and gouty individual. Various disorders of the female generative organs are exceedingly apt to cause an outbreak.

Certain medicaments may cause an attack of the affection, more particularly copaiba, cubebs, chloral, turpentine, quinin, opium, the iodides, the coal-tar products, antitoxin, etc.

LICHEN PLANUS.

Lichen planus may be acute or chronic, localized or of a generalized distribution. The areas of predilection are the flexure surface of the wrists, the forearms, the ankles, and the lower legs. In extensive cases there may be numerous lesions on both surfaces of the extremities and scattered over the trunk. The face, the scalp, the palms, and the soles, are rarely attacked.

The characteristic lesion is a pinhead to pea-sized, slightly elevated, flat papule, the base of which is irregular or angular in shape, and with an umbilicated, shiny surface, at times covered with a fine glistening scale. The lesions may remain discrete, but tend in extensive cases to form large confluent patches, of a violaceous hue, and covered with glistening silvery scales. The disease may run a chronic course, lasting, untreated, for months or years; the original lesions persist and new papules may appear.

Lichen planus not infrequently attacks the mucous membrane of the mouth, chiefly the inner surface of the cheeks, and occasionally the tongue. The lesions consist of white, whitish-lilac and grayish colored dots; practically non-elevated papules, plaques or streaks; resembling markedly

the appearance immediately after a cauterization with the nitrate of silver.

The disease is not frequent. Less than one per cent. of our dermatological cases are of lichen planus. The condition occurs in both sexes; usually in active adult life, and only rarely in childhood. It is chiefly found in private rather than in hospital practice, patients frequently being of a nervous temperament. Overwork, worry, anxiety, nervous shock, and exhaustive conditions, tend to cause an outbreak in those predisposed. It occasionally follows the course of nerves and nerve injury. Traumatism, digestive disturbances, malaria, malnutrition, and diseases of the generative organs, have all been cited as causal. Diabetes occasionally is a precursor of an outbreak. It has been suggested that as lesions develop in the course of scratch marks the disease is caused by traumatism following some disturbance of the nervous system (Jacquet); others take the traumatic origin of the lesions as the evidence of the parasitic nature of the affection (Hallopeau and Jomier).

PSORIASIS.

The affection starts with the appearance of a few pinhead-sized, slightly elevated, sharply margined, infiltrated red flat papules with thin whitish scales. These papules increase in number, size, thickness, and also in the abundance of the scale.

Although the affection may be of generalized distribution, in the majority of cases the disease is prone to attack the extensor surfaces of the extremities, particularly the elbows and the knees, and the scalp. The face is only exceptionally attacked, excepting that the patches may be observed along the hairy line of the forehead, extending downward from the scalp. The palms and the soles are rarely involved, and the dorsal surface of the hands and feet only exceptionally and in extensive cases.

The course of the disease is slow and recurrences are common. There seems to be a tendency for the affection to be more marked in winter and for relapses to occur during the cold weather. In mild cases there may be an almost complete

disappearance of the eruption in warm weather. Relapses may occur months or years after the previous outbreak.

There may be numerous patches present or only a few, and the lesions are small or of a large size.

The etiology of psoriasis is unknown. The disease comprises from two to seven per cent. of skin cases, varying somewhat in different countries. Males show a slightly greater predisposition to the affection than do females. Most cases are observed between the ages of fifteen and thirty years, sometimes younger and also at a later period.

Various constitutional disorders have been mentioned as causal: a rheumatic and a gouty tendency; defective kidney elimination; and pancreatic disease. The eruption is frequently worse or recurs during pregnancy or the nursing period.

It has been suggested that an abnormal retention of nitrogen is either causative of the affection or makes the outbreak more severe.

ECZEMA.

Eczema is an acute, subacute, or chronic inflammation of the skin, characterized by the development of erythema, papules, vesicles or pustules, slight or marked infiltration of the integument, a secondary scale or crust formation, and is accompanied by itching and burning.

Eczema may have its beginning on any portion of the integument; it may remain limited to the part first attacked; several parts may be attacked synchronously; it may have a more or less generalized distribution in the beginning, or may extend universally either slowly or rapidly. The outbreak is usually more or less localized. The eruption may consist of erythema, papules, vesicles or pustules, and later scales and crusts may be observed. Usually more than one type of outbreak is present. In other words, the eruption is frequently multiform, mixed, and very often one type predominates. The character of the outbreak is also apt to change as the disease progresses. For instance, an erythematous outbreak may by local irritation become vesicular; vesicles may likewise be added to the dry forms of the disease. In every type of the disease itching is a marked

symptom, and very often burning or the sensation of heat is also present. There is apt to be redness, possibly slight or marked swelling, frequently moisture, and the patches usually fade away into the sound skin.

The disease has been entitled acute, subacute, or chronic, but these terms can scarcely be applied accurately, because an outbreak may be of long duration and yet of a very acute type, or lasting but a short period and less acutely inflammatory.

Certain areas are prone to an outbreak at different ages; the face or scalp, or both, are more apt to be attacked in infants and young children; adults in active employment exhibit the outbreak usually upon the fingers, the hands, and the forearms; the scrotum and the anal regions in the male, and the vulva in the female, are often involved; and the face and the lower legs in the older female are not infrequently attacked. Adults show the tendency, more or less markedly, to an outbreak on the flexure surface of the elbows, the knees and the axillæ. The nails also may be attacked and are dry, and show a tendency to crack. Constitutional symptoms are absent excepting in the generalized type of affection.

Eczema comprises a large proportion of all cases of diseases of the skin. The writer, from the years of 1902 to 1912, observed 24,459 dermatological cases, and of this number 4142 were classed as eczema (16.9 per cent.). Eczema is not inherited, it is non-contagious, and excepting in generalized cases and after prolonged and continuous itching, does not affect the general health. There may, however, be an inherited tendency to an irritable skin, which may therefore be more easily excited to an eczematous outbreak by lesser stimuli than the average integument. The cutaneous covering of those of the blond type is usually more sensitive than those of darker coloring. A certain idiosyncrasy is the unsatisfactory explanation of causation that has to be given in a considerable proportion of cases.

Any internal condition which lowers the vitality of the individual naturally decreases the resisting power of the skin and makes the individual more susceptible to an outbreak. Gouty and rheumatic subjects are apparently prone to this

condition. Defective kidney elimination, uric acid, lithemia, albuminuria, diabetes mellitus, and diabetes insipidus, have all been accompanied by attacks of eczema. Various gastrointestinal conditions have been mentioned as causative, particularly incomplete metabolism. The term neurotic eczema has been applied to cases of this affection which are apparently more or less identified with the nervous system. Nervous shock and hysterical conditions have been mentioned as precursors of an attack. Functional and organic uterine disorders and nerve injuries have been thought to be etiologically significant. Certain outbreaks of the disease have been associated with asthmatic seizures.

In a paper read by the writer, in a symposium before the American Dermatological Association in 1912, the external origin of eczema was discussed at length, and it was determined that fully one-quarter of eczema cases are of external origin, and almost one-sixth are caused by the trade of the individual.

HERPES SIMPLEX.

A disease characterized by groups of vesicles occurring chiefly on the lips and contiguous portions of the face.

The outbreak consists of pinhead to pea-sized vesicles, frequently on an erythematous base, arranged in groups, which may be bilaterally situated, usually in the vicinity of or involving the mucous membranes of the lips. There may be only one or several groups of vesicles. Practically any portion of the cutaneous surface may be attacked, but the outbreak is usually observed upon the face. There may be a preliminary feeling of heat or burning in the part to be attacked, or the vesicles may appear without previous sensation. The lesions tend to break and to form into crusts. The affection lasts from a few days to a week. There is frequently a tendency to recurrence.

Lesions may not only be observed on the buccal mucous membranes but also on the gums, in the mouth, the tongue, within the nose, the larynx, the pharynx, the esophagus, the vagina, and the urethra.

Groups of vesicles may develop in certain individuals at each menstrual period, either on the vulva, within the vagina,

or elsewhere on the body. Herpes simplex is frequently observed in croupous pneumonia, in cerebrospinal meningitis, in malaria, at times in influenza, in typhoid fever, and rarely in variola, in scarlet fever, and diphtheria.

Herpes facialis is frequently associated with cold and also digestive disorders. Long exposure to the sun, particularly when on the water, is provocative of an outbreak. Dental irritation is at times apparently causative. Certain articles of diet, such as cheese, may predispose to an outbreak.

The affection runs a course of a few days to a week. There is, however, a tendency in certain instances for the outbreak to recur, particularly in the genital variety.

HERPES ZOSTER.

An acute inflammatory self-limited disease, characterized by the development of groups of vesicles on an inflamed base, unilaterally distributed, and following the course of one or more cutaneous nerves.

The attack may be ushered in with pain of a neuralgic character, which precedes the outbreak by a few days, a few hours, or appears synchronously with the eruption. There also may be chilliness, malaise, slight fever, or nausea, or all symptoms of every kind may be absent. The pain may continue during the course of the affection or may be entirely absent. Groups of pin-point to split-pea sized vesicles develop on an inflamed base, following the course of one or more of the cutaneous nerves or their branches. The vesicles are tense, their walls quite thick, the contents clear, and they do not tend to break, unless accidentally ruptured, but dry up, forming yellowish-brown crusts. The lesions tend to remain discrete, but exceptionally may run together and form small bullæ. In a few instances the contents become purulent or hemorrhagic; small scars frequently remain at the sites of former lesions. Rarely ulceration or gangrene occur.

The outbreak is almost universally unilateral, and the chest and back are the usual site of attack; the right side is more frequently involved.

In certain instances the mucous membranes may show involvement; such as the lips, the inner surface of the cheeks,

the tonsil, the tongue, the bulbar conjunctiva, and the cornea. The disease runs a course of a few days to two weeks. In a few cases the lesions remain quite small, of an abortive character, and dry up without reaching full development. Exceptionally pain, tenderness, burning, or itching, may remain at the site of an attack for a considerable length of time after the lesions have disappeared.

"Shingles" is a disease of early life. The majority of the writers' two hundred and eighty-six cases appeared between the tenth and thirteenth years. Numerous predisposing causes have been mentioned, such as exposure to draughts, various depressing agencies, certain poisons, carbon dioxide, belladonna, atropin, pyemia, carcinoma, measles, pulmonary inflammation, septicemia, hemorrhages, traumatism, malaria, puerperal eclampsia, spinal injections, vaccination, the passage of electrical currents, the extraction of teeth and dental caries, pricking with thorns, gun-shot wounds, and tapping of hydatid cysts. Any influence sufficient to induce inflammation of a sensory nerve or its ganglion may be followed by an outbreak. Operations upon the Gasserian ganglion may be a prelude to an attack. Some authorities consider that zoster is an infectious disease. The administration of arsenic has been provocative of an outbreak in quite a number of instances.

PEMPHIGUS.

A rare acute or chronic disease characterized by the development of bullæ, which usually arise from the sound skin, tending to form in successive crops, and accompanied by mild or severe constitutional symptoms.

Blebs, frequently the size of a pigeon's or hen's egg, may be found in any location but there is a great tendency to involvement of areas of heat and moisture and the mucous membranes.

Pemphigus may be divided into acute or chronic, and such extremely rare examples as foliaceus, and pemphigus vegetans.

Pemphigus is extremely rare in this country, particularly the acute form, the vegetative and foliaceus varieties. It

may occur in both sexes and at any age; the acute type is apt to be observed in early life. It is not hereditary.

Acute pemphigus has been observed in young girls with menstrual disorders. It has followed sepsis, vaccination, rheumatic and other fevers, diphtheria, the exanthemata, and from puerperal processes in the mother. Animals and their products have been causal, particularly from wound infections, in butchers and those handling meats. The similarity to the "foot and mouth disease" of cattle has been often mentioned.

The other types of the affection have been attributed to nervous influences, such as hysteria, functional nervous disorders, peripheral nerve injuries, diseases of the central nervous system, degenerative changes of the peripheral nerves and nerve centers, and autointoxication.

Bacteriological influence has been mentioned as causal in the various varieties of the affection, particularly in the acute type. Cocci have been found in a considerable number of instances, particularly diplococci and streptococci. The *Bacillus pyocyaneus* has also been isolated.

DIPHTHERIA OF THE SKIN.

The bacillus of Löffler gains entrance to the skin through some opening; in cracks, slight excoriations, erosions resulting from herpes, and in breaks in the continuity of the skin secondary to an eczema, an intertrigo or an impetigo. The former writers upon this subject considered the affection, in most cases, developed secondarily to other patches of diphtheria in the patient, and they also affirmed that every case had a diagnostic false membrane. The bacillus attacked the skin through some break in its continuity; this area would almost immediately become painful; it would puff up; there would be a profuse fetid discharge; a false membrane would form and the edge of the patch would become elevated and the bottom ulcerated. Not infrequently an attack of erysipelas would develop around the diphtheritic patch. The prognosis was grave because of absorption of the diphtheria toxins from the large surface involved. Paralysis, particularly of the extremities, has followed the clinical form.

It is not rare, however, to observe an attenuated form that consists of grayish plaques, more dry than moist, discrete and slightly spreading. These plaques are detached in about ten days, some persisting for a longer period, but without presenting a grave appearance.

Recently several cases of diphtheria of the skin have been reported in which there was no false membrane formation, but the lesions were of an impetiginous eczema aspect, or of the bullous or vesicular variety. The writer has seen cases of diphtheria of the skin which had the appearance of bullous impetigo, excepting for the virulent appearance of the lesions and a profuse cheese-like purulent contents.

It is proved that diphtheria of the skin may begin as a primary condition, remaining localized as such, or may be followed by involvement of the throat or larynx. The diagnosis has to be proved by means of smears or cultures. The prognosis of the localized disease is not grave; the chief danger is from sequelæ.

HYPERHIDROSIS.

An affection characterized by an increased production of sweat, of local or general distribution, slight or marked, either acute or chronic.

Generalized sweating to an exaggerated degree is an idiosyncrasy of otherwise normal individuals, and therefore is present through the life of the individual, or may develop secondary to certain diseases, and is usually most marked in the axillæ, the genitocrural regions, the hands and feet. The slightest exertion greatly increases the tendency, and in addition to being profuse during the summer, it is also marked in cold weather. Because of the amount of excretion and the chemical changes which the sweat may undergo, the individual is prone in warm weather to outbreaks of eczema, to boil formation, prickly-heat, and intertrigo (chafing). In rare instances sweating may be limited to localized areas or of a unilateral distribution. Unilateral sweating of the face occasionally occurs.

Sweating is frequently limited to the hands or feet alone, or both may show the anomaly. The condition limited to

both hands is rather frequent and is most marked on the palms and the palmar surface of the fingers. The sweating may be persistent or be excited by nervousness or excitement. It may exist in a mild degree or the excretion may be so copious that the sweat accumulates in drops and drips from the fingers. Gloves will frequently become saturated in a few hours' wear. Occasionally there will be deep-seated vesicles (pompholyx) associated with the sweating and a horny or wart-like thickening.

Severe or a mild degree of sweating is of quite frequent occurrence upon the feet, almost entirely limited to the soles and the plantar surface of the toes. The feet are constantly damp or wet, the socks or stockings moist or drenched a short time after they are put on, and in severe instances the shoe becomes water-soaked. In the cases with marked sweating the skin is macerated, soggy, pinkish-red or violet in color, puffy, and irritated. In addition there may be deep-seated vesicles in the affected areas, and, at the edge, abrasions and some vesicle formations. The sweat not infrequently has an offensive, fetid odor.

Excessive general sweating is generally associated with debility and is a symptom of some underlying disease, such as an incipient Graves's disease, tuberculosis, malaria, nervous influences, hereditary tendencies, and following convalescence from prolonged and debilitating conditions such as influenza. Idiosyncrasy is the unsatisfactory explanation of some of the localized cases, although flat-foot, malpositions of the feet, and nerve irritation (central or truncal), have been cited as causal. Certain articles of diet have apparently caused this condition. The sweat does not differ from that normally secreted.

DERMATITIS DYSMENORRHEICA.

A curious eruption has recently been described, which manifests itself during the menstrual periods and at no other time. The outbreak consists of spontaneous, usually symmetrical lesions attacking the face, the trunk and the extremities, composed of erythematous patches, urticarial wheals and vesicles. During pregnancy the eruption ceases to appear.

RAYNAUD'S DISEASE.

In this symmetrical form of gangrene a profound disturbance of vascular innervation is noted. The phalanges become symmetrically pale, bloodless, and painful. The affection may then proceed to the stage of asphyxia, the attacked areas become of a dark red, livid hue, swollen and tender, and later of a bluish to bluish-black, or black and gangrenous. Gangrene is usually of the dry form. The condition may remain without the development of gangrene for a considerable period or indefinitely but eventually, in most cases, death of the skin and the underlying tissues results. The condition is occasionally better during the summer months. The extremities, particularly the hands and fingers, are symmetrically attacked. The sufferers frequently have cold hands and feet. The ears, the nose, and other portions of the integument, may show the anomaly, but in these areas gangrene usually does not result. If gangrene does not result the affected parts become atrophic and indurated, and ulcers may be observed. There is frequently a considerable amount of burning and pain of the affected areas.

The condition apparently is due to trophic disturbances associated with changes in the nervous system. It is probably due to some underlying condition rather than a separate disease. The affection has been ascribed to cold, exposure, nutritional disorders, and neuroses. Raynaud's disease has been observed in connection with diphtheria, scarlatina, typhoid fever, measles, diabetes, malaria, hemoglobinuria, cardiovascular conditions, Bright's disease, exophthalmic goiter, hysterical affections, syphilis, tuberculosis, generalized scleroderma, and associated with eczema, hyperhidrosis, purpura, and urticaria. Both sexes and all ages have been attacked.

DERMATITIS MEDICAMENTOSA.

An inflammatory outbreak of generalized or localized distribution and of varying type, caused by the ingestion or absorption of drugs.

The external manifestations of drug absorption may be of any type, and general in distribution or with localized lesions,

depending upon the quantity of the preparation that has been administered, the length of time the remedy has been ingested, and any idiosyncrasy of the patient or derangement of the eliminative organs or the cardiovascular system. The outbreak may occur after one or only a few small or medium sized doses, in some individuals; in others the preparation may have been given over a considerable period; or the drug may be more or less cumulative, as with the bromids. Any drug may produce an outbreak in a predisposed individual. The drugs which most frequently give rise to an eruption are the bromids, iodids, arsenic, aspirin, copaiba, cubebs, and quinin.

Women and children are more susceptible to an outbreak. A weakened condition of the individual, particularly cardio-renal disease, defective elimination, and a nervous temperament, predispose to an eruption. Several theories have been promulgated: that the skin is irritated by the drug being eliminated through the cutaneous tissues and the glands; increased skin elimination due to a defective condition of the gastrointestinal tract and the kidneys; that the presence of the drug generates some toxin or irritant in the blood which causes the cutaneous outbreak; and that the drug acts upon the vasomotor centers or peripheral nerves. Engman and Mook found iodine or bromine in lesions caused by these preparations, and they consider that the drugs circulating in the body tissues may produce an outbreak, probably caused by the formation of a toxin acting at the points of present or former disturbances, such as on comedones, acne, and seborrheic lesions, scars, traumata, scratches, etc. In a large proportion of instances, however, no determinable reason for a drug rash can be ascertained, and the unsatisfactory deduction has to be made that the outbreak is caused by a certain susceptibility or idiosyncrasy.

DERMATITIS FACTITIA.

An eruption artificially produced, of a mild or severe character, usually observed in a neurotic individual, and for the purpose of exciting sympathy or for malingering.

The outbreak does not conform to any type of lesion but is of a peculiar rounded, linear or angular conformation, with

very sharp borders, and in right-handed individuals within easy reach of the right hand, while the reverse is true of those using mostly the left hand. Artificial dermatitis is usually in the form of ulcers, the individual having applied some form of irritant until ulceration occurs, and the lesions are not infrequently covered by black, gangrenous sloughs. There may be one or a great many ulcers, the patient by irritant applications continuing the process, continuously or intermittently, for months or years.

Suggestion is a remarkable source of a new outbreak, mentioning to the patient the possibility of a crop of lesions occurring on an unaffected part, not infrequently causes a self-produced outbreak on the area suggested. The affection is fortunately of rather unusual occurrence.

PURPURA.

A hemorrhage into the skin, of determinable or unknown origin, accompanied by or without constitutional derangement.

The affection can conveniently be divided into three groups, depending upon their severity: Purpura simplex, purpura rheumatica, and purpura hemorrhagica.

The mild form of purpura is usually unaccompanied by constitutional derangement or rheumatic symptoms. The attack is characterized by a sudden appearance of pin-point to bean-sized bright or dark red spots from which the color cannot be pressed, limited to the lower extremities, or with an associated outbreak upon the forearms. The affection usually reaches its height in a few days and the lesions then become of a bluish-red, violet-blue, and yellowish-brown; the active stage subsides with the leaving of temporary pigmentation. The affection usually runs a course of one to two weeks; exceptionally, however, crops appear over a few months, a year or longer. Subjective symptoms are absent or extremely slight.

The mildest form of purpura rheumatica, or arthritic purpura, is practically a simple purpura with the addition of rheumatic pains, occasionally swelling about the joints, and mild or severe constitutional symptoms including fever.

The more severe form of rheumatic purpura, known as peliosis rheumatica, or Schönlein's disease, is characterized by multiple arthritis, a purpuric outbreak, and lesions of an erythema multiforme and urticarial types. In addition there may be nodes indistinguishable from erythema nodosum, exceptionally vesicles or bullæ, and extensive areas of angio-neurotic edema (giant urticaria), with or without hemorrhagic contents. The term febrile purpuric edema has been applied to these cases.

The attacks start with moderate or high temperature, mild or severe articular pains, and sore throat. The throat symptoms, in certain instances, are severe, and sloughing of the uvula may occur (Osler). Endocarditis, pericarditis, and other symptoms of acute articular rheumatism, may be present.

Purpura hemorrhagica (Morbus maculosus Werlhofi; land-scurvy) may begin as a simple purpura without constitutional derangement, with mild systemic disturbances, or with grave symptoms. Those cases with a mild beginning may later develop moderate fever, considerable prostration, and typhoid fever may be simulated.

The lesions at the onset may be small and few in number, increasing rapidly or slowly in size and number until the greater portion of the integument is involved, and there may be extensive hemorrhages of the mucous membranes and the various internal organs. In favorable cases the disease terminates in from ten days to two weeks. In other instances profound anemia may rapidly develop and death results from loss of blood or cerebral hemorrhage.

The disease has been observed in epidemics. In rare instances, usually in children, the affection pursues a malignant course, terminating fatally in twenty-four hours (purpura fulminans).

The disease is not uncommon in the milder forms and is met with in both sexes and at all ages. A considerable number of cases have to be classed as idiopathic, as no etiological factor can be determined. The symptomatic causes of an outbreak may be classed under the headings, of microörganismal, infectious, toxic, cachectic, neurotic, and mechanical.

The various organisms which have been found in the blood or integument associated with the condition are the pneumococcus, streptococcus, colon bacillus, anthrax bacillus, bacillus pyocyaneus, staphylococcus aureus and albus, and certain undifferentiated organisms.

Outbreaks have been associated with pyemia, septicemia, malignant endocarditis, and with typhus fever, measles, scarlet fever, small-pox, cerebrospinal fever, syphilis, malaria, and rheumatism.

Toxic causes consist of venomous snake bites, and various drugs such as copaiba, quinin, belladonna, mercury, ergot, salicylates, chloral, and the iodids.

Cachectic conditions have been causal, as exemplified by cancer, tuberculosis, pseudoleukemia, Bright's disease, various disturbances of nutrition, cirrhosis of the liver, lung and cardiac conditions, chronic alcoholism, and the debility of old age.

The affection has been observed secondary to locomotor ataxia, acute myelitis, transverse myelitis, severe neuralgias, tuberculous meningitis, emotional and hysterical conditions, and the menstrual state.

The mechanical causes of an outbreak may be prolonged standing, relaxations of the blood-vessels due to intense heat, as in stokers, following paroxysms of coughing or epileptic attacks, tight bandages, etc.

SCLERODERMA.

Scleroderma differs considerably in its clinical aspects, in some instances exhibiting more or less diffused, hard, board-like areas, while in others the patches are sharply circumscribed or consist of bands, having a lardaceous appearance, with a pinkish border, and exceptionally a combination of the two. Although in certain cases these types may more or less approach each other, it has been thought best to describe the two conditions separately, the first being known as diffuse symmetrical scleroderma and the latter as morphea or circumscribed scleroderma.

The cause of the affection is unknown. A large proportion of cases occur in women, usually in the young or middle-

aged. The changes in the skin are apparently due to vascular changes, probably due to a lesion or defect of the nervous system. The various causes which have been mentioned are rheumatism, climatic changes, neurotic conditions, traumatism, injury to the nerves, extreme exposure to the sun, Graves's disease, Raynaud's disease, leprosy, Addison's disease, and various other morbid states.

CHLOASMA.

An affection characterized by pigmented spots or diffuse pigmentation of the skin. Smooth non-elevated, yellowish, brownish, or blackish patches, of varying size and shape, appear slowly or rapidly. The spots may be sharply margined or fade off into the sound skin. The patches are observed in most instances on the face, although no portion of the cutaneous surface is exempt, and in certain instances the mucous membranes are attacked. The diffuse variety of the affection may involve the trunk or a considerable portion of the integument.

The type associated with uterine and ovarian disorders usually attacks the face, and occasionally the breasts and the genitalia.

In Addison's disease the skin is either bronzed generally or it is most pronounced on the face, the neck, the scrotum, the groins, the axillæ, and surrounding the nipple. The mucous membranes of the lips, the gums, and other portions of the mouth, may be attacked.

In Graves's disease there may be diffuse pigmentation or freckle-like spots, with associated telangiectases.

Bronze diabetes, which is characterized by general bronzing of the skin, is a sequela of diabetes mellitus and hypertrophic cirrhosis, and was originally described by Hanriet and Chauffard. Osler has shown that diabetes and the bronzing of the skin is a late phenomenon, due to a disease termed hemochromatosis, characterized by accumulation of an iron-containing and an iron-free pigment.

Etiologically the affection has been divided into idiopathic and symptomatic chloasma.

Idiopathic chloasma is the term applied to the hyperpigmentation of external origin, such as from and following exposure to the heat and actinic rays of the sun, the roentgen rays, sinapisms, blisters, and certain drugs, the hyperemia or irritation due to pressure, friction, scratching, parasites, and following certain diseases such as chronic eczema of the legs, lichen planus, generalized exfoliative dermatitis, leprosy, scleroderma, etc.

Symptomatic chloasma is the form secondary to internal conditions, such as are observed in association with tuberculosis, secondary syphilis, sarcoma, organic affections of the uteroövarian system, chronic alcoholism, etc. Jaundice also is productive of a yellowish discoloration of the skin and mucous membranes.

ARGYRIA.

Argyria is the term applied to the permanent bluish-gray or slate-colored pigmentation of the skin which follows the prolonged administration of the nitrate of silver. The first manifestation is a bluish line at the margin of the gums, and the generalized discoloration of the skin develops gradually.

VITILIGO.

An acquired affection characterized by the development of patches without pigment. The affected areas are milky-white in color, irregular or rounded in contour, small or large, and frequently surrounded by an areola of increased pigmentation. The hairs in the depigmented patches usually exhibit the same change, although they may remain normal in color. One or many non-pigmented spots may be present. The usual sites of attack are the backs of the hands, the face, the neck, and the arms, and they may be distributed more or less symmetrically. The patches tend to increase in size and the tendency for new areas to develop may last over months or years; rarely the entire cutaneous surface is involved.

The affection is most frequently observed in brunets and negroes rather than in the blond type, and between the ages of ten and forty years. The cause of the disease is unknown, but it is probably a trophoneurosis.

XANTHOMA DIABETICORUM.

The eruption is secondary to a glycosuria, and an outbreak may appear gradually or rather rapidly. The lesions are usually, in the beginning, of a dull red color, but shortly most of them develop a minute yellowish summit which tends to spread to the elimination of a considerable portion of the inflammatory base. They are firm or hard, rounded or conical, sharply defined pin-head to pea-sized papules, mostly discrete but at times crowded together into a patch. New lesions may continue to appear, while some of those already formed disappear. Some of the lesions may show a predominance of the yellow color, and because of their flatness resemble ordinary xanthoma. Although a considerable portion of the cutaneous surface may be involved, the disease tends to attack the buttocks, the extensor surface of the forearms, the elbows, the knees, and the back.

PRURITUS.

An affection of the skin without eruption, except as the result of scratching, characterized by itching, burning, and pricking sensations. The pruritus is not infrequently limited to the genital and anal regions.

The affection has been associated with or is excited by hepatic derangement, tumors causing congestion of the pelvic viscera, uterine and ovarian disorders, intestinal catarrh and fermentation, the gouty diathesis, fissures, fistulæ, and hemorrhoids. Frequently no cause can be determined excepting the neurotic character of the patient.

LEUKEMIA CUTIS.

There are two types of cutaneous outbreak in this condition, a superficial and a deep variety, or a combination of the two. The first is characterized by hemorrhages (petechial and diffuse), papular, vesicular, urticarial and pigmented lesions, symptomatic erythema, diffuse scaly erythrodermia, and, rarely, a moist or scaly dermatitis accompanied by intense itching. The deeper lesions consist of ulcers and necrotic areas, usually attacking the mucous membranes and

secondary to the breaking down of hemorrhagic or lymphomatous deposits. Nodules and tumors of various size, shape, and color, are also observed. Although any portion of the body may be attacked, the usual sites of attack are the extremities and face. The nodules may be from a pea to a coffee-bean in size, few or numerous, of a pale waxy, reddish, brownish-red, or yellow-red color, firm or soft in consistency, movable, smooth or scaly, oval, round, flat and at times with a depressed center. Telangiectases may also be present. The tumors are small hen's-egg or larger in size, rarely present in large numbers, and grow slowly, with the tendency to break down.

FURUNCLE.

An acute circumscribed inflammation of the hair follicle with central necrosis and suppuration.

The boil starts as a painful, indurated, slightly raised papule, which forms a convex tumor and the induration spreads peripherally. Later the central portion softens and becomes yellow, while the surrounding skin is red and densely infiltrated. The epidermis covering the center of the furuncle finally breaks and pus is discharged through the irregularly shaped opening. The deepest portion of the boil is known as the core, which is spindle-shaped and consists of yellowish-gray necrotic tissue. After the lesion breaks, fragments of the core are discharged and finally the entire mass is exuded. The symptoms subside rapidly with the elimination of the pus. The process is at times checked before the suppuration occurs and resolution occurs without actual necrosis. This is designated a "blind boil" and does not progress beyond the stage of painful inflammatory induration.

Furuncles are frequently exceedingly painful and there may be considerable constitutional disturbances. They are apt to occur in those with glycosuria, albuminuria, and in individuals considerably below par.

The neighboring lymphatic glands may be enlarged, tender, and at times suppurate. Boils occur singly or in crops, coming out in certain instances for several weeks or months. The areas usually attacked are the neck, the face, the forearms,

the legs and the buttocks. In most instances they reach full development in from three to six days.

ERYSIPELAS.

Erysipelas may begin with intense chilliness or a distinct chill, nausea, sometimes vomiting, and fever, which precede the cutaneous outbreak by a few hours, a day or more, or the eruption may in mild cases begin without previous symptoms. One or more red spots appear at the site of infection. They become confluent and form a swollen, large, red, inflammatory, irregularly shaped and sharply margined patch that is tender, smooth, glistening, and elevated. As the inflammation becomes more intense the patch grows angry red in color, the swelling increases, the surface is more glazed in appearance, and vesicles and bullæ filled with clear yellow serum develop on the affected area.

The cause of erysipelas is inoculation through an abrasion of the skin or an adjacent mucous membrane, at times so minute as to be undiscoverable, or an invasion of wounds, burns, scalds, and the like, by the *Streptococcus pyogenes*. The lowered resistance of the tissues is a contributing factor. The disease most often occurs in middle life. Certain individuals are particularly prone to an outbreak. Causes which predispose by lessening the resistance of the individual are, chronic alcoholism, lack of cleanliness, and trauma. The specific streptococcus discovered by Fehleisen is apparently the cause of the affection.

KERATODERMIA BLENNORRHAGICA.

A rare affection characterized by symmetrical keratoses on the soles of the feet and palms, occurring secondary to gonorrhea. The condition was first described by Vidal, in 1893.

TUBERCULOSIS VERRUCOSA CUTIS.

Two types of the affection are recognized: The first is characterized by a single small red swelling, with a pustular head which developed at the point of inoculation. The lesion slowly enlarges and forms a warty nodule, with an infiltrated

base and a surrounding reddish areola. The pus removed from the small abscesses contains tubercle bacilli. There is usually enlargement of the contiguous lymphatic glands. This is the typical anatomical tubercle or *verruca necrogenica*. It usually occurs either on the dorsum of the hand or on the fingers.

The second type is characterized by the development of an ovoid or lobulated warty swelling which cicatrizes in the center and slowly spreads peripherally. The matured lesion has a depressed, often pigmented, cicatrix, surrounded by reddish-brown warty nodules which at times are covered with a grayish crust, and frequently an areola of a purplish-red color. The disease may last over a period of months or years, and exceptionally spontaneously involutes. Itching may be present. There is apt to be lymphatic involvement and occasionally the viscerae are attacked. The back of the hands (sometimes both) and the dorsum of the fingers are the usual sites of attack.

The cause of the disease is the inoculation by the human or bovine type of the tubercle bacillus at the site of a small break in the skin. It may occur in patients who rub the sputum-covered lips with the back of the hand. It is very likely to develop in medical students, physicians, laboratory workers, butchers, and handlers of dead tuberculous bodies.

ERYTHEMA INDURATUM.

The characteristic lesions consist of multiple red or purplish, indurated, ill defined plaques, usually from one-half to one inch in diameter. The swellings develop subcutaneously, run a chronic course, and tend to break down into deep ulcers with an irregular edge and a grayish or reddish infiltrated base. When the ulcers heal, pigmented depressed scars, which eventually turn white, result. The lower portion of the calf of the leg, particularly the outer and posterior aspects, is the area usually attacked. The outbreak is frequently symmetrical. Occasionally the upper extremities are involved. The condition is more apt to develop in young girls earlier than twenty-five years of age.

LEPROSY.

The tubercular or nodular is more common than the anesthetic variety of leprosy, it runs a more rapid course, and the skin is chiefly attacked. The typical lesions of tubercular leprosy consist of distinct nodules and more or less ill-defined areas of infiltration, with subsequent ulceration. The skin of the face, the ears, and often other parts, is thickened, with an accentuation of the natural lines and furrows. The earliest infiltration is usually observed in the eyebrows. The nodular or infiltrated masses, when well developed, cause great deformity of the parts involved, particularly the face, which has a leonine appearance. The areas of greatest involvement in most cases are the face, the ears, and the hands; the palms and scalp are rarely attacked. The tubercles are brownish or brownish-yellow in color, frequently quite large, and develop from preceding macular patches or from the sound skin. The nodules may persist indefinitely without change; disappear, leaving at their sites atrophied, thinned, pigmented skin or cicatrices; partial absorption with the formation of indurated raised fibrous masses may occur and many tend to ulcerate. New nodules appear from time to time. Fresh crops are frequently accompanied by fever and chilliness. The nodules on the extremities ulcerate, with the formation of shallow indolent ulcers covered with brownish crusts and a yellowish-brown discharge. Some of these ulcerations extend deep into the tissues, exposing ligaments and bones, while others are superficial and tend to heal. The lymphatic glands and channels leading to those of the neck, the groin and the axillæ, become enlarged, particularly in the vicinity of the ulcerating areas. These lymphatic glands and channels not uncommonly break down and ulcerate.

The mucous membranes of the nares, the mouth, the pharynx, and the neighboring channels, and also the conjunctivæ, have been attacked. The hair of the eyebrows, and at times the scalp, becomes dry, lusterless, and because of impaired nutrition eventually falls. The nails suffer nutritionally and become thickened, brittle and somewhat opaque. Early in the disease there is often increased activity

of the sweat and sebaceous glands, but later there is lessening of secretion.

In anesthetic leprosy the nervous system is chiefly attacked; characteristic anesthetic and macular patches are present. In this variety also the hair, the nails, the muscles and the subcutaneous tissue may undergo atrophy or degeneration. The affected parts become crooked, thinned, emaciated and otherwise distorted. Trophic ulcers are apt to develop, either spontaneously or as the result of injuries. The muscles atrophy, the fingers become permanently flexed and the hand claw-like. The bones eventually become diseased, the phalanges drop off or disappear by disintegration or absorption. The toes and the feet share in the same process. There may be a persistent perforating ulcer on the plantar surface of the foot. In certain cases the hands, the feet, in addition to the fingers and toes, are gradually lost.

The ulnar nerve is uniformly or irregularly thickened and gives a cord-like impression on palpation. There is loss of sensation of the mucous membranes of the mouth, the soft palate, the uvula, and the back of the pharynx. Deglutition is at times difficult and the food is regurgitated through the nose. The tubercular and anesthetic varieties of leprosy are not infrequently found in the same individual.

The cause of leprosy is infection with a specific bacillus, the *Bacillus lepræ*, which was discovered by Hansen in 1874. The exact method of inoculation is unknown, whether through the mucous membranes of the nose and mouth, or some break in the integumentary covering.

BLASTOMYCOSIS.

The disease starts as a papule or papulopustule, which soon becomes covered by a crust and the lesion slowly enlarges peripherally in the form of an indolent, flat, wart-like, or crusted nodule.

Well-developed patches are raised, the surface covered by irregular papillary elevations of a reddish color, separated by clefts or fissures of varying depth, giving it a verrucous or cauliflower-like appearance. The border of the patch slopes more or less abruptly from the elevated, roughened

surface to the normal skin, and it has a sharp margin. It is smooth, of a dark red or purplish color, from one-eighth to three-eighths of an inch in width, and contains a large number of miliary abscesses. These abscesses vary in size, and may be so small that they can only be distinguished with a magnifying glass. Some of these are superficial, while others are deep-seated. Abscesses of the same type are found on other portions of the growth. The specific organisms are obtainable from the mucus or mucopus contained in these abscesses; the smaller the abscess the greater the opportunity there is for obtaining a pure culture.

The papillomatous surface may be replaced in older lesions, in part at least, with a thick, elevated, scar-like formation, pinkish-white in color, irregular and often corded, or with a smooth shining surface. The disease runs a slow, progressive course, months frequently elapsing before a patch reaches a diameter of an inch or more. In approximately one-half of the cases there is more than one patch present. Central healing may occur, with a resulting cicatrix.

The regions usually attacked are the face, the hands, the wrists, or the forearms, although no portion of the cutaneous surface is exempt. The various viscerae have been attacked in a few cases and death may result.

The cause of the affection is the blastomyces, a pathogenic yeast fungus inoculated at a break in the skin surface. The organism is a rounded, oval or irregularly shaped body having a well-defined double contour, a homogeneous capsule, and a finely or coarsely granular protoplasm.

ACNE VULGARIS.

A disease of the sebaceous glands, characterized by the development of papules, pustules, blackheads, and at times, sebaceous cysts, running a chronic course, and usually associated with digestive disturbances and constipation.

The face is attacked, in most instances, either alone or in association with the shoulders and back, and less frequently the chest or other portions of the cutaneous surface.

Acne vulgaris usually develops between puberty and twenty-five years of age. It is frequently associated with

digestive disturbances, constipation, menstrual irregularities, chlorosis, general debility, lack of tone in the muscular fibers of the skin, and scrofulosis. Lack of cleanliness, dust and dirt, seem to predispose to an outbreak. Certain drugs, particularly the bromin and iodin preparations, are prone to cause an attack. Laborers in tar and petroleum products frequently show a profuse eruption. The condition is usually much worse during the monthly menstrual period. A fresh outbreak not infrequently follows indiscretions in diet, such as highly seasoned foods, excessive tea or coffee drinking, and indulgences in alcoholic beverages.

ACNE ROSACEA.

A chronic disease of the face characterized by congestion, capillary dilatation, papules, pustules, and occasionally hypertrophy of the tissues.

The nose, the cheeks, and forehead, particularly the first, are the sites of attack. Exceptionally the nose becomes slightly or markedly enlarged, the gland mouths widely dilated, and a tumor-like lobulated appearance is produced (rhinophyma). The color in this variety of the disease is a bright red or purplish red.

The affection develops usually after thirty years of age, and both sexes are attacked, women possibly more often. The predisposing factors are almost the same as in acne vulgaris. Tea, coffee and alcoholic beverages have a marked influence in causing a relapse or making the outbreak more severe.

HYPERTRICHOSIS.

The condition is characterized by an excessive or abnormal growth of hair.

Acquired hypertrichosis is usually of a limited character, but rarely it may be somewhat generalized. Although hair may be more abundant on the bodies of some individuals than others, the cases that usually consult the dermatologist are the women with a few long hairs scattered over the face, or a large number of hairs on the upper lip, the chin, the cheeks, and the neck. A few long hairs may be observed around the nipples in females.

Certain factors such as race, dark complexion, uteroövarian disease, menstrual disorders, local irritation, have all been mentioned as causal, but in a very large proportion of the cases, nothing predisposing or etiological can be determined.

ALOPECIA AREATA.

The disease is characterized by a rapid and complete hair fall in patches. The bald areas are usually the size of a quarter to a half a dollar, and there may be but one, two, three, or many present. The affected patch is entirely denuded of hair, slightly depressed, smooth, the hair follicles are less prominent than normal, the surface is white, non-inflammatory and without scale formation. The hairs surrounding the patch are firmly fastened in the follicles and are pulled out with a considerable amount of traction unless the area is spreading. There may be instead of a rounded patch, a linear area extending along the hair line, at the back or side of the neck, or at the hair-line of the forehead. Circumscribed patches are not only found on the scalp, but, in certain cases, in the bearded region, either alone or combined with the bald areas on the head. Small patches may run together and large areas are thus formed, or the one spot may enlarge until a considerable portion of the scalp is denuded of hair. Occasionally the hair loss is more or less generalized, not only on the scalp, but eyebrows, the eyelashes, the beard, the mustache, and in the axillary and pubic regions as well. Exceptionally every hair, including all of the lanugo growth, is lost (alopecia universalis). The condition runs a chronic course, but frequently the patches after reaching a certain size tend to remain stationary. In favorable cases the hair returns first as a downy growth, frequently of a pale or white color, and as it grows thicker and stronger, becomes pigmented of the natural color of the surrounding hairs. Changes in the nails occasionally may also be present.

Alopecia areata is usually observed between the ages of ten and twenty-five years; rarely under five or in those older than forty. Comparatively few cases are observed and either sex may be attacked. Two theories have been advanced as to its causation: parasitic or a trophoneurosis.

In regard to the neurotic theory of causation, numerous instances of the affection have followed fright, shocks, accidents, great anxiety, mental worries, etc. Other factors which have been mentioned are peripheral irritation from defective teeth and other reflex causes, such as defective vision, nasopharyngeal disorders and changes in the nerves.

LEUKOPLAKIA.

A disease which attacks the mucous membranes of the tongue, the inner surface of the cheeks, the gums, the lips, the floor and the roof of the mouth, and rarely the vagina or genitals of either sex. The disease is characterized by one, several, or more rounded, irregularly shaped or diffused, often more or less thickened, whitish patches, with at times a tendency to fissure.

The patch may start with an increased redness, or slight bluish tinge of the affected parts, or the papillæ may be slightly raised, and there is a variable degree of sensitiveness to hot and acid foods. After some weeks or months the diagnostic whitish and opaline appearance is observed. The original whitish lesions may appear as parallel, short or long, straight or crooked lines, or as scattered or grouped pinhead to small pea-sized spots. These areas run together and form the larger plaques. The surface is smooth, roughened, or somewhat papillomatous, and there may be an encircling hyperemia. The lesions run a chronic course, and ulceration and malignant change may occur, or after reaching a certain development they may remain more or less stationary.

Although syphilis has been given as the cause of the affection, in those cases seen in this country it is only one of the etiologic factors. The conditions which predispose to or aggravate leukoplakia are excessive smoking, alcoholic beverages, hot, highly seasoned, irritating, and acid foods, various gastrointestinal disturbances, and sharp or rough teeth.

SYPHILIS.

Syphilis, for convenience of study, may be divided into three stages and three incubation periods. The first incuba-

tion period is from the time of infection until the appearance and development of the initial lesion, usually three weeks, sometimes more or less. The primary stage is characterized by the fully developed indurated initial lesion and the typical glandular enlargement. In the secondary period of incubation, which lasts, as a rule, about six weeks, various concomitant signs of syphilis are developed, increasing in severity as the secondary or eruptive stage is reached. The secondary stage is characterized by the appearance of the eruption and various other symptoms, to be described in detail. The third period of incubation is of indefinite duration, lasting from a few months to a few or many years. The third stage is also eruptive in type but is more destructive than the secondary period, and localized rather than generalized.

The primary sore or chancre is soft in consistency in the early stage, practically no induration being noted before the tenth day. Slight induration can usually be palpated about the fourteenth day. The penis, or some portion of the female genitalia, is the usual site of attack. Densely indurated chancre, the true Hunterian sore, is not so usual as the erosive type, the chief location being the sulcus coronarius. An extragenital chancre usually appears as a small red papule with more or less scaliness, and tends to become crusted. The initial lesion on the lip usually occurs upon the vermillion, frequently extending to the skin surface. Exceptionally the glands may be palpable on the fifth day after the appearance of the sore, and as a rule, between the seventh and the tenth, but in certain cases much later. The lymphatic glands are painless, densely indurated, freely movable, separate from each other, and feel like almonds or little round tumors. The most marked enlargement is usually noted in the ganglia near the initial lesion, although general glandular enlargement of the superficial lymphatic glands frequently occurs before the eruption appears.

During the stage of secondary incubation various signs of the constitutional involvement of the patient develop, such as anemia, wandering pains over the tibiae, the sternum, and articulations, a cachectic appearance, severe persistent headache, some loss of weight, a dingy or unhealthy tint to the

skin, and general lassitude. The eruption may be ushered in by moderate or high fever at times being mistaken for typhoid, frequently however, none of these signs of constitutional involvement are present. The various symptoms are found, as a rule, in those who are physically unfit to resist the disease. The above symptoms, if present, usually appear a few days to a week or more before the eruption. The secondary eruption of syphilis has certain characteristics; it is more or less generalized and somewhat symmetrical, although certain types show predilection for various areas. It may be stated, in a general way, that the favorite areas are the upper part of the forehead, just at the margin of the hair, the angles of the mouth, the nasolabial folds, the palms, the soles, the region of the anus, and the genitalia. The eruption may be abundant or somewhat scanty, and varies considerably in duration. In relapses the eruption is much more scanty and usually less generally distributed and with more tendency to grouping.

It should be well noted that in the beginning or recent eruption the color is frequently pink or even reddish which, however, after some days or weeks tends to become dark red and then the time-honored "ham color." The lesions are usually oval or round, but at times are somewhat irregular in conformation. Infrequently in the white, but frequently in the negro, the lesions, particularly on the face, are circinate. The later the lesions the more tendency there is to grouping; the greater the depth and the less general is the distribution. In tertiary lesions there is a characteristic diagnostic tendency to segmental, circinate, and serpiginous arrangement. The scars of the late lesions take the diagnostic shape of the former eruption. Usually in syphilis more than one type of eruption is present, thus at times assisting greatly in the diagnosis.

The syphilodermata of the active or secondary stage usually appear somewhat rapidly and attain full development in one or two weeks, after which it is not uncommon for a few new lesions to show themselves irregularly for a short time. In some cases there may be a scanty scattered outbreak at first, followed in one or two weeks by numerous lesions, or the eruption may remain scanty. After a few

weeks the macular syphilide has pretty generally disappeared. In other types, however, there is often a stationary period for a month or so, disappearance gradually taking place in a few months, occasionally leaving persistent lesions as those on the palms, or the soles. The papular eruption tends to relapse for some months. In the tertiary stage there is found very little tendency to spontaneous disappearance.

Various signs or symptoms of the disease are associated with the active or secondary stage, being known as the concomitant signs of syphilis. The chancre often persists or the scar is found; generally adenopathies are present, pharyngitis, mucous patches, or superficial ulcers on the inner surface of the lips, the mouth, the pharynx, etc. Iritis, cephalalgia, bone pains, sallow or dingy-looking skin, cachexia, and loss of flesh, may be present.

Frequently but a few of these symptoms are present in a case. Concomitant symptoms are frequently wanting in the tertiary stage, although bone lesions and pain, alopecia, superficial glossitis, and leukoplakia, may be present. Alopecia, thinning of the scalp hair, "moth-eaten appearance," is more usual in the secondary than in the tertiary stage, but is infrequent at the most. In this condition there may be simply thinning of the scalp hair, but at times incomplete bald areas may be seen; the hair frequently becomes dry, lusterless and lifeless in appearance. The nails also may be attacked; furrows, depressions, opacities, thickening of the nail itself, with brittleness of its edge, may be noted. The macular is usually the earliest and most common of the secondary syphilitic types. It is generally distributed, being most abundant, as a rule, on the sides of the trunk and the axillary folds, the umbilical region, the neck, and the flexure surface of the arms. The palms and the soles also may show numerous lesions, with a tendency to become papular.

There are several varieties of the papular syphiloderm, which may be classed under the headings of the miliary papular, the flat papular, and the papulosquamous. The miliary papular is a fairly common variety, but much less so than the flat papular. The flat papular syphiloderm varies

from pinhead to bean or larger in size. There is usually a predominance of either the large or small type in each case.

Moist papules, or so-called mucous patches, are usually met with in the secondary stage. They are generally situated on opposing surfaces where there is a certain amount of natural heat and moisture and some friction. The usual location is around the anus and genitalia, particularly in women; the perineum, the genitocrural region, the corners of the mouth, and the nasolabial folds; the axillæ and umbilical area are not unusual situations. At times lesions become hypertrophic, distinctly elevated, with an irregular surface; they are then known as condylomata.

The pustular syphilodermata occur in several distinct types. They are much less frequent than the papular, and are usually noted in those individuals who are poorly nourished. The pustular eruption may be classed under two general headings: the acuminate pustular and the flat pustular. These two forms are divided into the large and the small.

The palms, chiefly, and also the soles of the feet are frequently involved by dry, syphilitic eruptions, such as the macular, the maculopapular, the papular, and papulonodular, and the nodular. There may be a certain tendency to fissuring.

The late lesions of syphilis may be classified under the heading of tertiary, and are generally divided under two subdivisions, the nodular and the gummatous, with various modifications of each. An indefinite incubation period of months or years frequently elapses between the early or secondary period and the late or tertiary. The late lesions are, as a rule, few in number, show a great tendency to grouping, are destructive, and do not heal spontaneously. The group or the single lesion is arranged as a segment of a circle, with a serpiginous or crescentic border, kidney-shaped. Previous scars, ulceration, or scarring in the lesion under observation, is frequently of assistance in diagnosing syphilis.

The nodular form exceptionally occurs within the first year of the disease, but usually much later. It generally appears as a very late secondary, or years afterwards as a tertiary, outbreak.

The syphilitic gumma is usually a late manifestation of the disease. The gumma is hard in the beginning but be-

comes soft and doughy, tending to break down and ulcerate. Usually the ulcer resulting is "punched out," and shows a tendency to be kidney-shaped. The favorite sites for the gummatous lesions are the soft parts, particularly of the thigh and calf. No region, however, is exempt from attack.

The cause of syphilis is the *Treponema pallidum*, which was discovered by Schaudinn and Hoffmann, in 1905. This organism is an extremely delicate filament, coiled to form a grayish spiral, and has almost the same refractive index as the medium in which it is placed; hence the former difficulty in its recognition. The spiral arrangement is maintained not only during movement but also in the state of rest. The movements are very slow compared with the other spirochetes. According to the discoverers it varies in length from four to fourteen microns. The number of undulations or twists of which the organism is composed ranges from ten to twenty-six, with an average of twelve (Schaudinn).

Diseases of the Blood

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Diseases of the Blood.

FOREWORD.

THE blood may be regarded as a liquid tissue, whose chief function is to serve as a system of transportation of various substances from and to the various organs and tissues of the body. It also serves as a repository and storehouse of certain materials, particularly foods, an excess of which is always kept in the body. The red blood cells apparently carry only oxygen and carbon dioxide, therefore the plasma, containing various substances in solution, is the chief transportation and storage agent. Aside from the ability to determine the percentage in the plasma of some of these substances, such as serum albumen, globulin, glucose, the various non-coagulable nitrogenous substances, cholesterol, the various inorganic substances, particularly sodium chloride and calcium, very little if anything of the pathology of the plasma is known and the available tests are usually more valuable for the purpose of estimating the disorders of other organs than those of the blood itself. On the other hand, because of various staining methods, the study of diseases of the blood has been chiefly advanced through the examination of the cells by the microscope, which is used for inspection and enumeration.

One cubic millimeter of blood is universally adopted as the standard quantity for counting. The limits, which may be regarded as representing the maximum and minimum normal figures for red blood cells, are between 4,000,000 and 6,000,000. These numbers may be found in persons otherwise normal, but the extremes are rare, and ordinarily any count below 4,500,000 or above 5,200,000, otherwise unexplained, should indicate a careful clinical study of the case. Technical proficiency on the part of the counter is always presupposed.

The *red cell count* is moderately increased after hard exercise, after great excitement, and when the atmospheric pres-

sure is reduced, therefore, after transfer to a high altitude. These changes are probably due to a response by the organism to an increased need for oxygen by the tissues, and as soon as the emergency has ceased, the count returns to normal. Acute cyanosis is also accompanied by high counts. It has also been shown that the injection of adrenalin in amounts sufficiently large to produce physiological effects, will cause an increase of the number of erythrocytes in the peripheral blood. In health and in normal conditions, the red blood count is quite constant.

The *number of white blood cells* is more variable, less so in the adult than in the child, and less in the male than in the female. It may be assumed that the usual normal limits are from 6000 to 10,000, but numbers both above and below these limits are not unusual in otherwise normal persons. The proportion of the different cells varies widely. It may be determined by counting the percentage of each variety, or by calculating the absolute number of each type in a cubic millimeter. As this latter calculation is made from the total count and the percentages, it adds only a complication and the additional possibility of error. It does, however, often give a clearer idea of the changes that have occurred.

The normal *percentages* are as follows:

	Per cent.
Polymorphonuclears: Neutrophilic cells	50 to 80
Eosinophilic cells	1 " 3
Basophilic cells	0 " 1
Lymphocytes:	10 " 25
Large mononuclears (including transitionals):	5 " 15

A fairly typical *quantitative count*, if there are 7000 leucocytes, might be as follows:

Polymorphonuclears	4900
Lymphocytes	1400
Large mononuclears	700

Hemoglobin is estimated on an arbitrary scale of 100. In normal blood its percentage value should be twice the first two figures of the red blood count. Probably no clinical laboratory test is made as inaccurately as the hemoglobin test by the instruments usually employed. Tallqvist's scale

should be discarded. The method of Palmer with an efficient colorimeter, such as Duboscq's, is adequate, but too difficult and complicated for the ordinary clinical laboratory.

A transient increase in the number of white cells occurs during digestion, after violent exercise, in early infancy, after splenectomy, and after the injection into the body of various foreign substances, particularly foreign proteids. It may also occur just before death.

Leucopenia precedes the leucocytosis, usually for a very brief period, after the injection of dead bacteria.

Age has a definite influence upon some of the diseases of the blood; none upon others. All the diseases of the blood of known etiology may occur at any age. Of the diseases whose cause is not known, pernicious anemia, polycythemia, and purpura may occur at any age. The frequency of occurrence of the different forms of leukemia is influenced by age. Chlorosis occurs only in youth and hemophilia presumably lasts throughout life. Of the various forms of splenic anemia, if the term may be used, Banti's disease may occur at any age, von Jaksch's occurs only in young children. Gaucher's disease begins in childhood, and of the two forms of hemolytic icterus, the congenital or Chauffard-Minkowski type begins in infancy and the sporadic or Hayem-Widal type during adolescence. There is no form of blood disease peculiar to middle or old age.

CLASSIFICATION OF THE DISEASES OF THE BLOOD.

I. *Those of known etiology.*

1. Diminution of the red cells, or secondary anemia, as a result of a hemorrhage, poisons, cachexia, chronic infections, or parasites.
2. Diminution of the hemoglobin content of the red cells, after hemorrhage.
3. Increase of the white blood cells. Leucocytosis.
 - (a) In infectious fevers and inflammation.
 - (b) As a result of the injection of irritants, as turpentine.
 - (c) After splenectomy.
4. Decrease of the white blood cells. Leucopenia.
 - (a) In infectious fevers.

- (b) In certain endocrine disturbances.
 - 5. The hemorrhagic diathesis.
 - (a) In hypertension. Probably not a condition of the blood.
 - (b) In passive congestion, as in the diseases of the mitral valve and cirrhosis of the liver. Again rather vascular than hemic.
 - (c) The result of poisons, particularly snake venom, and the infections.
 - 6. Hemolysis. This is exceedingly rare in the vessels of the living body. It occurs after the transfusion of blood from unappropriate donors, and as the result of serpent venom.
 - 7. Gas poisoning, particularly with carbon monoxide, and cyanide poisoning.
 - 8. The presence of living parasites in the blood. These are so various and numerous that it is not possible even to enumerate them all, but they may be grouped as follows:
 - (a) Bacteria. Probably nearly all infectious forms may be found.
 - (b) Spirochetes.
 - (c) Plasmodia.
 - (d) Filaria.
 - 9. Increase of the red blood cells, as a result of transfer to a higher altitude.
- II. *Those of unknown etiology.*
- 1. Anemia.
 - (a) Pernicious. Aplastic or heteroplastic.
 - (b) The forms associated with splenic enlargement.
 - (c) The form associated with lymph gland enlargement.
 - 2. Leukemia.
 - 3. Chlorosis.
 - 4. Polycythemia.
 - 5. Purpura.
 - 6. Hemophilia.

Of the conditions under Group I only secondary anemia (1) and the hemorrhagic diathesis due to hypertension (5a) will be considered, as the others belong more properly under

the discussion of their associated conditions. Of the conditions included under Group II, all are germane to this article with the exception of chlorosis (3), which is a disease of young women.

SECONDARY ANEMIA.

There are two clinical forms recognized, the acute and chronic.

Acute secondary anemia is produced by a massive hemorrhage. The blood picture is characteristic. There is a reduction of the number of red cells, in the very beginning not so pronounced, because the total volume of the blood is reduced, but in a brief time, the blood volume is restored and the reduction of the red cells is roughly proportionate to the amount of blood that has been lost. The effort on the part of the blood forming organs to restore the cells then results in the presence in the blood of a number of young cells, and there are found many cells slightly smaller than normal, but not microcytes, a much larger proportion of reticulated cells, a moderate number of cells showing polychromatophilia, and occasionally a few normoblasts. The amount of hemoglobin is reduced proportionately more than the number of red cells and the color index is less than unity. The blood platelets are increased. The white cells, particularly the polymorphonuclears are increased only temporarily, unless there is some other factor present that causes leucocytosis. The subsequent changes in the blood picture depend upon the previous condition of the patient, the cause of the hemorrhage, the amount of blood lost, the repetition of the hemorrhage. In acute traumatic moderate hemorrhage, not repeated, occurring in a vigorous healthy individual of middle life, the restoration of the blood occurs very rapidly. In old age, in cachexia, and in lesser degrees of malnutrition and exhaustion, the restoration is either greatly delayed, or the anemia may persist and ultimately cause death.

The *causes* of acute hemorrhage are many:

1. Traumatism. If external the diagnosis is easy, if internal, the diagnosis may be difficult and only clinical study including the blood picture will determine the blood loss. An unusual case of this type was a man thrown to the

ground and trampled on by a panic stricken crowd. He was brought to the hospital in collapse, the blood count was low and free fluid was detected in the abdomen. At the subsequent autopsy blood was found in the peritoneal cavity due to a ruptured liver. In another case a coachman fainted on the box. He had received a blow on the side several days previously, but had thought little of it. The left pleural cavity contained fluid, which was apparently pure blood, and the x-ray later revealed a fractured rib. This was after aspiration. Presumably an intercostal artery had been torn at the seat of the fracture. The patient rapidly recovered.

In all cases of sudden collapse, the blood should be studied; although the appearance of the patient often suggests the occurrence of internal hemorrhage.

2. Rupture of a diseased blood-vessel; usually an aneurism. The blood may be lost through the mouth, if the rupture occurs into the lung or upper part of the digestive tract; through the anus, if, as is rarely the case, the aneurism ruptures into the intestines; or the blood may be retained in one of the cavities of the body. A negro was admitted to the hospital with a left pleura full of liquid. He was excessively pale, wherever pallor could be detected. The blood picture was that of secondary anemia, and therefore hemothorax was diagnosed. A curious feature was the pulsation of the thorax and a loud murmur heard over the left chest. At autopsy, a ruptured subclavian aneurism was found, opening into the pleural cavity. A case that died too soon for a careful clinical study had a huge pericardial sac filled with blood as the result of the rupture of an aneurism at the apex of the left ventricle. The epistaxis and hemoptysis that occur in hypertension are due to vascular rupture.

3. Massive hemorrhage of uncertain nature into the intestinal tract occurs in cirrhosis of the liver, and in cases of splenic enlargement, particularly Banti's disease.

4. Massive hemorrhage from ulceration of the bronchial mucous membranes occurs in early tuberculosis; of the gastric mucous membrane in peptic ulcer; from the intestinal tract in duodenal and early tuberculous ulcers.

The *symptoms* of acute anemia are: Pallor. The skin is white, waxy, and sometimes has a slight yellowish tint. The

sciera are usually blue white, but sometimes have a slight yellowish tint. The pupils are dilated. The skin is usually moist, the extremities cold. The temperature of the body is subnormal. Depending upon the degree of hemorrhage, there is a sense of weakness, dizziness and often syncope. If the hemorrhage cannot be controlled, death ensues.

The amount of blood lost may be guessed roughly by the amount seen, and the general appearance of the patient and the severity of the reaction. Blood counts are important and should be made as soon as it is possible to spare time from the urgency of checking the hemorrhage.

A case of acute secondary anemia was as follows: A man 58 years of age, who had never been sick, whose life had been easy and habits, except for the indulgence of a very healthy appetite, very good, suddenly felt very faint. He lay down and shortly afterwards passed a considerable amount of tarry material and some bright blood from the bowel. He vomited twice, but the vomitus contained no visible blood. He was given shortly after this a dose of calomel, and had two more attacks of faintness. At this time his pallor was appreciable. When I saw him two days after the initial attack, the hemoglobin was 27 per cent.; red blood cells, 1,200,000; white blood cells, 11,000. The blood picture was polymorphonuclears, 69 per cent.; lymphocytes, 26 per cent.; large mononuclears, 5 per cent.

Murmurs were heard everywhere over the heart. The pulse was distinctly receding. After measures had been employed to check further bleeding, improvement in the blood picture was rapid, and the blood of none of several available donors was required. The source of the hemorrhage was supposed to be the small intestine, although no history of previous gastric disturbance could be obtained. In a similar case with partial obstruction, a diverticulitis was found.

The *treatment* of massive hemorrhage divides itself into two parts: (1) Measures to prevent the recurrence of the hemorrhage. (2) Measures to restore the blood. Measures to check or prevent recurrence may be surgical as well as medical. All accessible bleeding vessels should be secured and all bleeding surfaces treated as may be required. As a rule bleeding from gastro-intestinal ulcers soon ceases, and

if any considerable hemorrhage has occurred, they stand operations badly. I have always believed that a hemothorax should not be aspirated immediately unless it is known that no further hemorrhage can occur.

The medical measures consist of the administration of substances supposed to increase the coagulability of the blood; and later, of various measures to increase the corpuscular content of the blood.

Four substances are usually accepted as of value for promoting coagulability, these are in the order of their usefulness: 1. Thromboplastin, prepared from animal brains. It appears to be effective, it produces no anaphylaxis, no serum sickness, and may be repeated without danger. The ordinary dose is 10 c.c. injected subcutaneously with all aseptic precautions, including painting the skin with tincture of iodine. It is not certain that a second dose increases its effectiveness.

2. Horse serum. As a matter of fact any other serum will do as well, but horse serum is usually more easily obtained. Some danger is involved, therefore the patient should receive a desensitizing dose of 1 c.c. subcutaneously, and one hour allowed to elapse. If then there is no reaction, 10 c.c. may be injected, either subcutaneously or intravenously. If the latter route is selected, the injection should be given at the rate of 1 c.c. per minute. From six to ten days later, the patient may have an attack of serum sickness, with fever, pains and urticaria, but it is never serious. The serum should not be repeated if there has been an interval of six days after the first injection. Horse serum seems to be quite as effective as thromboplastin.

3. Gelatin. This is of very doubtful value. It must be carefully prepared and sterilized. A 10 per cent. solution of gelatin should be made in normal salt solution, filtered through paper and sterilized by the fractional method to destroy all spores of tetanus, which constitute the chief danger. The injection is often very painful. The preparation requires at least forty-eight hours, and should only be done by a competent bacteriologist.

4. Calcium salts. The lactate or chloride should always be given, usually one gram per day for four days. They can only aid any other method and are useless alone.

Local styptics may be used. Cocaine and adrenalin may check a severe expistaxis.

Severe hemorrhage from the mucous membranes may occur in the course of some of the diseases of the blood, such as leukemia, pernicious anemia and purpura hemorrhagica, but in none of these do local measures have much effect. In the leukemic forms x-ray treatment usually checks the hemorrhagic tendency.

There is only one effective method of restoring the blood, and that is by transfusion. With proper precautions, healthy blood of a suitable type, preferably tested also by cross agglutination, and the operation performed by an expert, is a safe procedure and should be given if the hemorrhage has been severe, or if the blood count is below 2,000,000 or the hemoglobin below 30 per cent.

Chronic secondary anemia occurs in cases in which there are repeated small hemorrhages or when there is some condition, assumed to be a form of poison, that destroys the blood. The causes are very numerous. Repeated bleeding may occur from almost any mucous membrane, it may be an exacerbation of a physiological process, as in menorrhagia, or the blood may be sucked from the intestinal mucosa by a parasitic worm. Anemia may occur when there is infestation by parasites, particularly the *Bothriocephalus latus*, in chronic infections as malaria, streptococcic infections, in amyloid disease, in starvation, and in defective food, as beri-beri. Sometimes no obvious cause is found, nevertheless the clinical course and the blood picture exclude pernicious anemia.

The blood shows reduction in the hemoglobin and red cells, the color index is low, and changes are present in the white cells such as may be produced by the underlying cause. The patient is pale, listless, the nutrition is usually poor.

The treatment consists in the removal of the cause if possible, if not, such palliative measures as iron, arsenic, bitters, fresh air, rest, over feeding, and change of climate may be employed. If no focus is evident, search must be made for some focus of infection, such as a sinusitis, an abscessed tooth, an infected tonsil, and the many other foci that have been so industriously described during recent years.

HEMORRHAGIC DIATHESIS DUE TO HYPERTENSION.

The hemorrhagic diathesis of hypertension is a disturbance of middle and old age and appears in various forms. The most common are epistaxis and hemopytysis; hematemesis and melena are rare. Epistaxis for some reason, occurs most frequently at night, and does not seem to be the immediate result of active exercise. It is often profuse and difficult to control, but if not exhausting, is beneficial.

Hemoptysis usually occurs in association with some infection of the respiratory tract, especially a tracheitis or bronchitis, a small amount of blood accompanying the sputum expelled by coughing, but it may also occur as a single hemorrhage, not often excessive, with little tendency to repetition. Tuberculosis is suspected in practically all cases, but as the blood-pressure is commonly low in pulmonary tuberculosis, no case of pulmonary hemorrhage with high pressure should be regarded as tuberculous unless other signs than hemorrhage are present.

Hemorrhage from the gastro-intestinal tract is produced by so many causes, often obscure, that it is not easy always to determine which, if any, are due solely or in part to increased blood-pressure. Passive congestion must not be confused with hypertension.

Hemorrhage from the genito-urinary tract is not uncommon, it is not accompanied by pain, and is often considerable. The urine is thoroughly mixed with the blood and may resemble pure blood. Clots are rare.

Hemorrhage into the skin is not frequent. It occurs in two forms: First, massive, bruise-like subcutaneous extravasations. Sometimes peculiar sensations, sharp pain, tingling or discomfort are felt at the subsequent site of the hemorrhage two or three days before it appears. Then the skin becomes discolored, at first bluish black, then green and yellow. It seems as if the hemorrhage may have occurred in the deeper tissues, probably sometimes the muscles, although I have never been able to confirm this. Second, petechial hemorrhages into the skin, these may occur in the legs, and occasionally in the skin of the forearm after the blood-pres-

sure has been taken. (The tourniquet test.) Their appearance is usually accompanied by a tingling sensation.

The *treatment* of these hemorrhages is local and general. The local treatment can be used only on the nasal mucous membrane. It consists of the application of cocaine, adrenalin, or some of the styptics derived from tissues. Packing may also be required.

The general treatment may be that of hemorrhage, and has already been described, or better the treatment of hypertension, that is rest, restricted diet, nitrites, sweat baths, and, when indicated, venesection.

This usually prevents the recurrence of the hemorrhages.

PROGRESSIVE PERNICIOUS ANEMIA.

Progressive pernicious anemia is a term usually applied to a fairly well marked clinical condition, that is characterized by a diminution of the red blood cells, of the hemoglobin, no secretion of the gastric juice, numbness and progressive weakness of the legs, and that ultimately after a progressive or remittent course terminates in death. It was first recognized and described by Addison.

This disease usually occurs in adults, particularly in males, but cases in females are by no means uncommon. It usually begins after thirty-five years of age. The onset is gradual, and cases are usually seen for the first time by a physician after they have reached a comparatively advanced stage.

The cause is wholly unknown. Various chemical substances such as lipoids and fatty acids have been described as possible factors; infectious agencies (streptococcus and parasites, particularly intestinal) may produce similar conditions; also tumors of the bone marrow (myelophthisic anemia). Disturbances of the endocrine system are sometimes present.

I have reported one case of pernicious anemia in a man with various female characteristics. It is said that some cases of pernicious anemia show certain features in the anatomy of the bones, but this has not been established.

The *blood picture* is characteristic. The red blood cell count is reduced; often the actual count is below one million, and in one of my cases a count of 520,000 was made, and in

another, several residents independently made counts of less than 500,000, but unfortunately did not record their figures. The red cells are of all shapes and sizes, poikilocytes and macrocytes. They stain well with eosin and other red cell stains, but some of the cells show stippling, reticulation and polychromatophilia. Nucleated red cells are usually found, megal-, normo- and microblasts, and may from time to time be very numerous, this is assumed to be an indication of a tremendous effort put forth by the bone marrow to overcome the blood deficit. The fragility of the red cells is reduced. Each cell contains an excess of hemoglobin and the color index is higher than unity. The white blood cells are usually reduced, the leucopenia being due to the absolute reduction of the polymorphonuclear forms; and in consequence there is a percentual lymphocytosis; rarely, in the later stages myelocytes may appear. The platelets, as a rule, are only slightly diminished.

The physical signs are fairly characteristic. The expression is dull, although the face may become animated, the sclera are bluish white, and the pupils rather wide. The skin has a characteristic lemon yellow tint, somewhat similar to the hemolytic anemias, and distinguished from a light icterus by the blue sclera; as a rule the nutrition is fair, but in the later stages, there may be wasting and some edema of the limbs. The pulse is quick, and often of the Corrigan type, that is, it is more easily felt if the arm is in the vertical position. The heart dulness may or may not be enlarged; but murmurs are heard in all parts, particularly at the base, they are usually loud, harsh, systolic in time, and in the neck there is a "bruit de diable". The systolic murmur is usually heard in both axillæ. The veins are small. The edge of the liver and the spleen may be palpable, but neither is constant. Sometimes, however, the spleen is considerably increased in size, and forms a palpable hard tumor in the left upper quadrant. Dyspnea on exertion is common, fatigue occurs easily, but often in severe anemia the patients are able to work. One of my patients continued as chief clerk in a large office with a blood count of less than 1,000,000, and the day she entered the hospital it was 617,000. The earliest spinal symptoms are numbness in the feet particularly at night, then some tingling

and discomfort amounting at times to actual pain. Later there may be a feeling of uncertainty in walking, and sometimes complete or almost complete disability.

The sensory disturbances are the loss of vibratory conduction. This should be tested with a tuning fork (A108.75) specially prepared so that a definite amplitude of vibration can be determined, and from this the duration of the vibratory sensation measured with a stop watch. Normally it is from 15 to 25 seconds over the internal and external malleoli and slightly longer over the lower ends of the ulna and the radius. Touch, pain and temperature sensation may be well preserved and are rarely seriously impaired; the sense of position is usually defective and may be almost completely lost. There is apparently astereognosis. The motor disturbances are ataxia, which is rarely marked, but sometimes especially in old people, is very severe and makes locomotion difficult. As the most frequent lesion is a combined sclerosis, the reflexes are usually increased, but if the involvement of the posterior columns is more pronounced, they are diminished or lost. The sphincters are not disturbed. The spinal cord symptoms do not improve during the remissions, and are usually progressive.

The results of *instrumental examination* are of much importance. The sphygmographic tracing is similar to that of aortic regurgitation. The electrocardiogram is not characteristic, except that left preponderance may not be present as it is in aortic disease. The blood-pressure is higher in the leg than it is in the arm; and vibratory sensation in the bones of the legs is usually lost early in the course of the disease, and always diminished when the patient is first seen.

The *laboratory findings* are also valuable. Total achylia gastrica is almost constant. The free hydrochloric acid is absent, the total acidity is low, and the fasting contents small in amount and nearly neutral, but none of the depressive symptoms of achylia gastrica are present. The pancreatic secretions have been present and apparently of normal activity in every case that I have tested, and this without the stimulating action of free hydrochloric acid. Much stress has been laid upon the study of the bile pigments in the duodenal contents; but the results have little clinical value.

The *course* of the disease is extremely variable. The anemia may be progressive, leading in a few months to death, or it may increase steadily although slowly, and the patient may live for years. Inexplicable remissions may occur, with an improved blood count, often as much as 4,000,000, improved strength, and relief of all symptoms, particularly the gastrointestinal, but it should be noted that if the signs of spinal disease are present, these do not share in the improvement, and as these are more common and severe in patients who have passed the first half century of life, they concern this article more definitely. From time to time there may be attacks of diarrhea that weaken the patient and cause great discomfort. Periods of fever are not uncommon. The temperature is usually irregular, moderately high, and is borne by the patients extraordinarily well, often for periods of months. In the later stages edema is common in the legs, and sometimes there is a general anasarca, not often severe; pleural and pericardial exudates are occasionally present, but ascites is extremely rare. In the last stages there is sometimes a mild delirium. Death occurs as the result of gradual weakness, sometimes apparently hastened by a severe diarrhea.

The nutrition is usually fair, and sometimes the patient actually becomes obese during the remissions, but at the end there is much wasting.

The *treatment* is palliative, but remissions may follow some of the measures employed, for which these measures may or may not be responsible.

The general measures are those common to almost all forms of disease, rest, including tranquillity, adequate ventilation, protection from the cold, bodily comfort, an adequate diet with hypernutrition if there is a tendency to lose weight. These need not be particularly described.

The special measures that may be employed are three:

1. The administration of iron and arsenic. The value of iron has been questioned. It has been supposed that it contributes to and stimulates the formation of hemoglobin, and in certain blood diseases, particularly chlorosis, it has been extolled as a specific; but there is no adequate proof that it actually does stimulate blood formation or inhibit

hemolysis. On the other hand there is sufficient evidence that it can be given to patients for long periods without apparent bad results and therefore it is still given. The dose should be moderate. If given by the mouth the tincture of iron chloride is satisfactory, about 1.0 c.c. (℥xv), given preferably two hours after meals to escape its inhibitory effect upon the digestive ferments. If there is evidence of syphilis, the syrup of the iodide, 2.0 c.c. (5ss), may be used; or Bland's mass, 0.2 Gm. (gr. iij), or reduced iron, 0.1 Gm. (gr. iss), be tried. For hypodermic use the citrate of iron, 0.06 to 0.08 Gm. (gr. 1 to 1¼), may be given daily.

Arsenic should always be administered, for it often has a distinct effect in improving the patient's condition. By the mouth, Fowler's solution in ascending doses, or the arsenic trioxid, 0.002 Gm. (gr. ⅓₃), usually combined with iron, seems useful; for hypodermic administration the cacodylate of sodium, 0.06 Gm. (gr. j), combined with ferric citrate, 0.06 Gm. (gr. j), is convenient, repeated once daily. The usual signs of overdose should be sought, and upon their appearance the arsenic discontinued. Herpes zoster may occur during the administration of arsenic.

Transfusion of blood from other human beings is the best measure hitherto discovered. The nature of the effect produced is not clearly understood. The improvement is not due wholly to the administration of corpuscles, although the introduction of washed corpuscles is beneficial, but apparently not as useful as the whole blood, but the improvement continues often for a considerable time, and therefore the ultimate improvement of the blood must be due to other factors than its mere temporary enrichment.

There are two theoretical explanations; that the donor's blood inhibits hemolysis or that it stimulates blood formation. As there is no general increase of the younger cell forms in the blood after transfusion, it would seem that the inhibition of hemolysis is the more likely explanation. The empirical fact of improvement is the only real justification for transfusion.

Transfusion requires knowledge and technical skill. The donor must be carefully selected. The blood of human beings is divided into 4 Types according to the character of

the cross agglutination and hemolysis. Type I can be agglutinated by all other types, Type II by Types III and IV, Type III by Types II and IV and Type IV cannot be agglutinated. This is probably due to the varying presence in the blood of two hemolyzing substances according as both, one, or none occur. As Type IV does not agglutinate in the blood of any recipient, it can be used in all cases; the others must be carefully selected. In all cases the donors should be typed, cross agglutination tested, and the donor's blood tested for syphilis, and all chronic and constitutional disease excluded as thoroughly as possible. In one of my cases I suspected, without being able to confirm my suspicions, that the husband might have been a malarial carrier. The patient with severe pernicious anemia was transfused with her husband's blood which answered all tests. The operation was apparently successful, but a few hours later she developed hyperpyrexia and died. Both came from a malarial district in the South, and the husband had had malarial fever, at least so diagnosed, several times. A successful transfusion produces no reaction. If a reaction occurs, the earliest signs usually appear while the operation is in progress. The first sign is a flushing of the face, then restlessness, often with fear of impending death, dyspnea, increased frequency of the pulse, pain in the lumbar region of an intense character, a chill followed by a high fever, and sometimes collapse. If there is hemolysis, the urine contains hemoglobin. The patient may die, otherwise the recovery is rapid, although fever may persist for days. If any of these symptoms occur, transfusion should be stopped and adrenalin administered.

Despite all precautions reactions may occur. In the case of a woman fifty years of age, who in the course of eighteen months had been transfused eight times from several donors, a severe reaction occurred during the fourth transfusion from one of these donors, after all the blood tests had been repeated with great care. Hemoglobinuria was not present. The reaction is similar in some respects to the anaphylactic reaction that occurs with serum.

Only arbitrary rules exist for transfusion. It is my rule to employ it if the red cell count falls below 1,000,000. The quantity to be taken is usually 500 c.c., to be repeated accord-

ing to the subsequent course of the case. Even in very desperate cases, transfusion should be attempted. One of my cases, was unconscious, pulseless and with shallow and almost imperceptible breathing, when the transfusion was commenced, and revived while it was still in progress, and actually lived several months longer. His first transfusion had been performed three years previously.

The technic of the operation does not belong here. The citrate method is the safest.

Splenectomy is less used than formerly. A complete history of this operation is given by Krumbhaar in "The Spleen and its Diseases," by Pearce, Krumbhaar and Frazier. The remarkable feature of this operation is the comparative safety with which it can be performed in patients suffering with severe anemia. It usually produces an immediate rise in the blood count which may endure for some time. In one of my cases, an irregular fever that had persisted for six months, and probably longer, for it was present when the patient entered the hospital, ceased immediately after splenectomy and did not recur. Six months after the operation the patient reported, apparently well, stated that he was working and his blood count was normal. He did not report again, and could not be found. Unfortunately the spleen was not examined or cultured. My impression is that the operation should be done only when transfusion ceases to be effective, and possibly when there is persistent fever. It should probably never be done if the cardiac symptoms are pronounced.

Aplastic anemia occurs in a few rare conditions that destroy the bone marrow. Among these are osteosclerosis; tumors invading the bone marrow, either primary or secondary, myelophthisic anemia, and certain poisons particularly benzol. Signs of deficient blood formation may occur in certain severe infections, such as streptococcic infections, pneumonia, and after intense radiation.

Idiopathic aplastic anemia is a rapidly progressive fatal disease of the blood occurring usually in asthenic individuals, occasionally with evidence of status lymphaticus. It is supposed, chiefly on account of its similarity to benzol poisoning, to be due to some form of poison or toxin, but as no such

toxin has ever been found, such an assumption is unwarranted. It occurs usually in adults and often follows a period of lack of energy.

The usual signs of anemia are present, pallor, without as a rule much if any discoloration of the skin, rapidly progressing weakness. Hemorrhages into the skin and from the mucous membranes are characteristic, but may vary greatly in amount.

The most characteristic feature in the blood is the great reduction in the number of platelets. The red cells are reduced, and this reduction is rapidly progressive. The color index is about normal or slightly below. There is leucopenia as a result of the reduction of the polymorphonuclear cells. The red cells, as one would expect, show few immature cells, therefore nucleated and reticulated cells are rare, and there is much less deformity of the cells than in the heteroplastic type. To the reduction of the platelets may be ascribed the hemorrhagic diathesis.

Death occurs in the course of two or three months after the disease has been recognized. Treatment is of little avail, arsenic and iron seem useless, transfusion has only a temporary beneficial effect, and is distinctly less useful than in the heteroplastic forms. Splenectomy should be harmful on theoretic grounds and experience seems to confirm this. Possibly the administration of calcium or other substances to promote coagulation may temporarily diminish the hemorrhagic tendency. Transfusion also helps this.

LEUKEMIA.

Leukemia is a disease characterized by the appearance in the blood of immature leucocytes and a great increase, during the greater part of the disease, of the total number of white blood cells. Associated with these features are anemia, often profound; enlargement of the spleen, liver and lymph glands, but not equally in the different forms; and at times, hemorrhages from the mucous membranes, fever, attacks of diarrhea, and an increased metabolic rate.

The only constant feature is the over production of white blood cells, and their introduction into the circulation, often

in an immature form; not only this, but masses of cells may be found in the various tissues. The number of leucocytes may be many hundred fold normal. The blood chemistry is not generally altered. The non-protein nitrogen is not increased, the blood sugar remains normal, there is no definite change in the saline constituents.

True leukemia is a disease of wide spread distribution in the animal kingdom, for it occurs not only in the human race but also in many species of animals; not only among mammals as dogs, swine, mice, but also among the birds, as chickens. It is altogether likely that, as the diseases of the lower animals are more carefully studied in zoölogical gardens, it will be found in many other species.

Leukemia must be distinguished from the increase of the white cells that occurs in some of the inflammatory diseases, and after splenectomy, in which the excess of white blood cells is due to the increase of the number of polymorphonuclear neutrophilic leucocytes; and from a few conditions in which certain other normal cells are present in excess, as in the eosinophilia of Trichiniasis.

The nature of leukemia is unknown. The theories that seem to accord rather better with the characteristics of the disease than the others, are: First, that it is due to some infection. In favor of this is the febrile course of many of the cases; the transmissibility of fowl leukemia, and the supposed association of leukemia with certain infections. As the latter involves the assumption of a peculiar reaction on the part of the patient, and as this involves an underlying predisposing cause, and particularly, as the majority of cases cannot be associated with a preceding infection, this theory may for the present be dismissed from consideration.

Second, that leukemia is akin to tumor formation, that is, that the leucocytes proliferate as do the epithelial cells of carcinoma, but as these cells live in a liquid stroma, the tumor continues to circulate in the blood stream. There is no better explanation for the proliferation of the leucocytes, but there is no proof that it is correct. An additional fact of no present significance, however, is the response of leukemia to x-ray treatment and to arsenic.

Third, that leukemia is due to an abnormal stimulation of the functional activity of the bone marrow, by something, for example a toxin, but as nothing of this nature has ever been found, there is no reason to assume its existence.

It must not be supposed that the presence of a few myelocytes in the blood constitutes the diagnosis of leukemia, for they are found occasionally in pernicious anemia, in carcinoma and in other conditions in which the bone marrow is involved. It is rather their continued presence, associated with a great excess of white cells and other changes in the body, that constitute the picture of the disease. I desire only to emphasize the fact, that a high leucocytosis, above 50,000, is not of itself sufficient to establish the diagnosis, for this may occur in various infections, and I have counted 100,000 white cells, 95 per cent. of which were of the polymorphonuclear type, in pneumonia, and higher counts in infections have been recorded.

According to the predominant types of cells, the leukemias have been divided into myelogenous and lymphatic; according to the course into acute or chronic. The clinical course of these different forms is distinctive, and there is no evidence that they pass one into the other, hence they may be regarded as different not only clinically but also morphologically.

Acute leukemia is a disease of early life, although it may occur at any age. Chronic leukemia is rare before twenty years of age. After this the myelogenous form predominates until sixty. Chronic lymphatic leukemia is not common until after forty-five. All forms are rare after sixty.

CHRONIC MYELOGENOUS LEUKEMIA.

Chronic myelogenous leukemia is the most common form of leukemia, except in early life. It occurs chiefly between the ages of 25 and 50, but has been observed in infants and in the aged. It is slightly more frequent in males than in females, the disproportion being less than in the other forms.

The onset is gradual, usually the patient complains of lassitude, then observes enlargement of the abdomen, then succeed gradually, pallor, dyspnea and palpitation, increasing weakness, periods of fever, occasional hemorrhages from the

bowels and mucous membranes, diarrhea, edema including ascites, and almost inexorably death. During the course there may be remissions either spontaneous, which are rare, or induced by treatment.

Sometimes one feature sometimes another attracts the attention of the patient, usually it is the lassitude, occasionally splenic tumor, in one of my cases the first symptom was a severe hemorrhage from the gums. The symptomatology develops rapidly, but the course is variable and irregular. Often some of the symptoms are absent. The lassitude increases, sometimes there is fever and sweating, diarrhea usually occurs in the more advanced cases, and may be paroxysmal, nutrition is impaired, and in the later stages a syndrome resembling that of toxic goiter may develop. Ordway and Gorham call attention to the tolerance for cold, and explain it by the increased metabolic rate.

The physical signs are pallor, a suggestion of exophthalmos, at least the eyes are bright and slightly staring, sometimes distinct pulsation in the vessels of the neck; vigorous pulsation of the precordium, the enlarged abdomen, and towards the end edema of the extremities. The tonsils may be slightly enlarged. Neuroretinitis has been observed, and was discovered in one of my patients by Dr. de Schweinitz. The disturbance of vision was very slight.

The spleen is nearly always greatly enlarged, and usually is the most striking feature. It may reach to the brim of the pelvis, and extend to the right of the median line. It moves with respiration, the surface is smooth, the substance firm, about as hard as sclerosed liver, the notch is usually distinct, and is not tender. In some cases the spleen does not enlarge, and of this I have seen one instance. In no other respect did the case differ from other cases, and the patient responded quite readily to treatment. The liver is slightly enlarged in the majority of cases, sometimes considerably; the lymph glands are rarely involved.

The diagnostic features are the changes in the blood. There is usually a great increase in the leucocytes, and counts exceeding a million are not uncommon. The characteristic feature is the presence of myelocytes. A few actual counts will illustrate this better than a general description.

CHARACTERISTIC BLOOD COUNTS.

Mild Type.

Hemoglobin	89%
Red blood cells	4,500,000
White blood cells	16,200
Polymorphonuclears	66%
Lymphocytes	8%
Large mononuclears and transitionals	11%
Eosinophils	4%
Basophils	5%
Myelocytes, neutrophilic	6%

Severe Type.

Hemoglobin	75%
Red blood cells	3,950,000
Nucleated red cells	2
Platelets	120,000
White blood cells	250,000
Polymorphonuclears	56%
Lymphocytes	2%
Large mononuclears and transitionals	10%
Eosinophils	5%
Basophils	2%
Myelocytes, neutrophilic	22%
eosinophilic	2%
basophilic	1%

The chemical changes in the blood are uncertain. There is no increase in the non-coagulable nitrogen and there are some contradictory reports regarding the phosphorus excretion, otherwise the blood chemistry is slightly, if at all, changed. The basal metabolism is always increased, and the increase is often as great as it is in hyperthyroidism. Ordway has collected the cases and finds that the increase averaged 44 per cent. in 5 cases of myelogenous leukemia. In one case I found 22 per cent. above normal. This decreases after successful treatment by the x-ray and in my case became normal. The white blood cells are said to have diminished phagocytic power, and they contain a proteolytic ferment. The blood-pressure is usually considerably higher in the leg than in the arm; as illustrated by the following two examples:

		Left leg	Left arm
CASE I	{ Systolic	180	135
	{ Diastolic	110	80
CASE II	{ Systolic	165	124
	{ Diastolic	110	70

The conduction of vibratory sensation through the bones is not affected, as it is always in a pernicious anemia.

The gastric contents contain pepsin and free hydrochloric acid and the pancreatic ferments are present.

CHRONIC LYMPHATIC LEUKEMIA.

Chronic lymphatic leukemia is distinguished from the myelogenous form in its clinical picture, particularly by two features, the frequency of changes in the tonsils and the tendency to hemorrhage. In some cases the enlargement of the tonsils is the earliest sign, and tonsillectomy may be performed with serious results, for a grave and even fatal hemorrhage is likely to ensue. It is perhaps useless to urge that every case of enlarged tonsils, not manifestly infected, should be studied carefully for other signs of lymphatic leukemia before operation is undertaken, but it should always be done, if there is any possible doubt, especially if the differential count indicates a preponderance of lymphocytes.

Hemorrhages occur from the mucous membranes, and are often profuse and difficult to control. Petechiæ and purpuric spots may appear in the skin. They are usually early manifestations. In addition a number of skin lesions have been described, some of which may precede any of the other signs of leukemia. These are various but have all been grouped under the term leukemiacutis. Almost all forms of skin lesions have been observed, but the more general forms resemble eczema. Sometimes there are tumors and nodules and rarely a form that resembles granuloma fungoides. All forms itch intolerably. Histologically they can sometimes be differentiated by the lymphocytic infiltration of the skin.

The physical examination shows marked enlargement of the lymph glands. They are discrete, movable, not tender. Involvement shows a tendency to be symmetrical, although this may be due to the almost universal enlargement. Often

the percussion note over the manubrium is dull. This may suggest enlargement of the thymus or of the glands of the superior mediastinum. The spleen is moderately enlarged. It can usually be palpated, but not always. It is distinctly harder than normal. The liver is slightly enlarged. The heart is enlarged, and over it can be heard a variety of murmurs, due partly to the changes in the blood, more frequently to relative insufficiencies.

The physical examination of the lungs is usually negative. Occasionally pleural transudate may occur.

The blood picture is characterized by the presence of a great number of small cells resembling the ordinary lymphocytes of the blood, usually surrounded by a thin rim of protoplasm, which does not contain granules by any of the ordinary stains. Frequently some of these cells may loose their protoplasm and often undergo further degenerative changes. There is a marked leucocytosis, often several hundred thousand white cells to the cubic millimeter, and the changes in the reds are similar to those of progressive pernicious anemia. The prognosis is fatal. Remissions may occur, usually as the result of treatment. The disease progresses, hemorrhages occur, slight fever appears, and the patient dies of cachexia.

CHARACTERISTIC BLOOD COUNT.

Hemoglobin	50%
Red blood cells	2,950,000
White blood cells	37,200
Polymorphonuclears	7%
Lymphocytes	90%
Large mononuclears and transitionals	2%
Eosinophils	1%

(From a male, 55 years of age, with severe nephritis, who showed 100 mgm. of blood-sugar per 100 c.c. of blood, and 450 mgm. of blood non-protein nitrogen.)

ACUTE MYELOGENOUS LEUKEMIA.

This is a condition in which leucocytosis develops, runs a very rapid course for a few weeks, and terminates in death. It may follow some minor infection. The characteristic feature is hemorrhage from the mucous membranes, especially of the mouth, ulceration or gangrene of the mucous mem-

branes of the mouth, and general hemorrhagic diathesis, or a condition resembling purpura hemorrhagica. Any of these forms may be febrile. In appearance there is the usual pallor of leukemia, there is enlargement of the glands of the neck and often of the other lymph glands. The spleen and liver are only moderately enlarged. There may be a hemorrhagic pleural exudate. The skin often contains smaller or larger hemorrhages as do also the mucous membranes. There are frequent hemorrhages of the gastrointestinal tract, and the patient may have severe and exhausting attacks of diarrhea. In the early stages it is said that leukopenia frequently occurs. In any event, in a very short time, the white cell count increases, the blood then contains large mononuclear cells, the protoplasm of which contains neutrophilic granules. It is generally believed now that a final differentiation between large lymphocytes and large mononuclears on the one hand, and myelocytes and myeloblasts can be made by means of the oxydase reaction, which is essentially the same reaction as that used for determining the presence of occult blood. Naegeli is the protagonist of the myelogenous nature of this form of acute leukemia.

ACUTE LYMPHATIC LEUKEMIA.

Acute lymphatic leukemia is a disease particularly of early life. It is only necessary to state that it resembles the acute myelogenous leukemia; that the blood picture shows particularly an excess of small lymphocytes, although large lymphocytes with pale nuclei may be seen. Myelocytes of any type may be present. There is the same tendency to hemorrhagic diathesis, gangrenous process in the mouth, fever and death.

TREATMENT OF LEUKEMIA.

The treatment of all forms of leukemia is essentially the same, but the results of the treatment are not uniform in the different types. There are three methods which, as a result of ample experience, have proven to be of value in leukemia; these are arsenic, radiotherapy and benzol. No other forms of treatment at the present time need be considered.

Treatment by Arsenic. Until 1900 and even later, arsenic was the one remedy available for the treatment of leukemia. It may be given in various ways, but the important point is to introduce as much arsenic as possible into the patient without producing symptoms of poisoning. Almost any preparation of arsenic will do, but the most convenient, and the one which has been used most extensively, and concerning which, therefore, there is the most information is Fowler's solution. A small dose is given at first, perhaps 5 minims three times a day, increasing at the rate of one minim per day until the patient has either pain in the epigastrium or slight swelling of the tissues around the eyes. The dose is then reduced one-half or one-third and continued indefinitely until either the patient's condition is satisfactory or death has occurred. To this iron may be added.

Arsenic may also be given hypodermically in the form of cacodylate of sodium, one decigram (gr. $1\frac{1}{2}$) every day or every other day, or in the form of salvarsan intravenously, starting with a comparatively small dose of 2 to 4 decigrams (gr. iii to gr. vi) once a week; or a proportionate amount of neosalvarsan.

Arsenic must not be used at the same time as radiotherapy is used, but it may be used during the intervals occurring between the other form of treatment.

Radiotherapy. This was introduced by Beclère in 1904. The effects are so satisfactory, indeed so dramatic, that it has practically superseded all other forms of treatment, and these are now used only as adjuvants.

I have the belief that there are certain essential things requisite successfully to employ radium or x-ray.

First, that the treatment shall be given by one who is experienced and skillful in its use.

Second, that no effort be made to produce sudden results by large doses, rather the treatment should be given conservatively and carefully.

Third, that the treatment should not be continued until a profound leukopenia has occurred.

Fourth, that during the treatment the patient should be kept under the most favorable physical conditions, not exposed to variations in temperature, and not permitted to do

anything that will cause fatigue, indeed, as a rule it is better that the patient remain quietly in bed, leaving it only to receive the treatment if necessary. This is particularly important in the beginning.

There are two methods each of which has its advocates—treatment of the bone marrow, and treatment of the spleen. The results seem to be approximately equal. Once the white blood count has been reduced to normal, the treatment should be discontinued. These are merely the statements of a clinician who does not use the treatment but has had opportunities of observing its use by others. When the blood count increases again, the x-ray should be re-employed, and, in the interval, arsenic may be used. Radium may be used in place of x-ray. The effects are excellent, but apparently no better than are the effects of x-ray. Excepting in the large centers, radium is more difficult to obtain. Ordway, however, believes that radium is the most effective treatment at our disposal at the present time. One important fact must be remembered, during either the x-ray or radium treatment, no irritant applications should be made to the skin. One of my patients, a man of sixty-five, whose leukemia had been held in check successfully for about five years, shortly after his return home from the last x-ray treatment, developed a trivial pain in the epigastrium. The nature of this pain was not investigated. His wife, in an effort to relieve him, applied a mustard plaster to the skin. This caused an intense reaction with the development of erysipelas, general sepsis and death. The patient should therefore always be warned not to use iodine, mustard or any form of counter irritant, no matter what the indication may be, after x-ray treatment.

The *benzol treatment* was suggested by Llewellys Barker. The administration of benzol is by the mouth in 5 decigram doses, usually given with equal parts of olive oil, in capsules, in increasing doses, starting with 2 capsules the first day, and increasing one capsule every day, until 8 or 10 are being given. The latter is the maximum dose. The treatment should be discontinued if the number of white corpuscles has been considerably reduced, or as soon as 20,000 has been reached.

There are certain disagreeable results, particularly gastric disturbances, following the use of benzol and related compounds. There is danger of producing too severe a reaction; it does not appear to be as effective as the x-ray or radium, and gradually its use is becoming less common.

Splenectomy has also been employed. According to the Mayo Clinic, this seems more effective if used after radiation of the spleen, but the results have not been sufficiently encouraging to justify the operation. It is said that leukemia sometimes improves after a severe septic infection from which the patient recovers. It is very difficult to obtain satisfactory case reports upon this subject. It is extremely doubtful, because there are cases of leukemia which seem to be very susceptible to septic infection and die promptly when such an infection occurs.

The *response to treatment* of the different types of leukemia is variable. Of all types the chronic myelogenous responds most rapidly, either to arsenic, x-ray, radiation or benzol. Probably no cures are obtained, but life may be prolonged for many years if the patient can be kept under observation, and the treatment employed whenever there is a tendency to relapse. The chronic lymphatic form does not do nearly so well. It is my impression that in this form the x-ray should be used with extreme care, very small doses being given at first and gradually increased as the patient seems to improve. In one of my cases, a severe form of the chronic lymphatic type, death occurred three days after the first application of radium, although only one half of the usual dose was applied. I feel that it would have been wiser if even a smaller dose had been given.

The acute leukemias appear to be extremely refractory. Treatment has very little effect upon them, and they usually proceed to death with little if any delay as the result of medical interference. Having seen a moderate number of cases, and having developed definite impressions upon the subject, I am inclined to believe that the most effective treatment, at present, is the administration of arsenic in some form, particularly subcutaneously. Other methods of treatment may also be employed.

In how far personal impressions are valuable I do not know, as a rule they are not only worthless but sometimes, if attention is paid to them, they are misleading; nevertheless I have acquired an impression, for which I lack the support of any definite observation or experimental work; and this is that the cause of leukemia is an animal parasite, probably related to the spirochete, and I harbor the hope that either in some selective poison, or in some anti-parasitic substance, a cure will ultimately be found.

POLYCYTHEMIA WITH SPLENOMEGALY.

In 1892, Vaquez observed a child notable for an extreme and persistent cyanosis. He diagnosed stenosis of the pulmonary valve, but when the patient died the heart was found to be normal, and he then concluded that he had observed a previously unrecognized disease, probably of the blood. The case was remarkable for the fact that the number of red blood cells considerably exceeded 5,000,000. Subsequently, Osler called attention to Vaquez' article, reported four cases of his own, and mentioned some other reports in the literature, in which a very high red blood cell count had been made, some of which were in excess of 10,000,000 per cubic millimeter. In the majority of these cases the spleen was found to be enlarged. It appeared therefore that a new symptom complex had been discovered by Vaquez, to which various names have since been given. Of these the most generally accepted is the descriptive term Polycythemia with splenomegaly. Of late, however, Erythremia has also been used. The term Erythrocytosis is also employed to indicate an excessive number of red blood cells in the blood.

Polycythemia with splenomegalia is characterized by a peculiar cyanosis, evidence of deficient oxidation of the blood, and enlargement of the spleen. Its cause is unknown. Its onset is equally unknown, for it is never recognized until it has reached an obvious stage of development. Its course is chronic. Death usually occurs from some intercurrent condition, usually pulmonary. In one of my cases the terminal symptoms were intracranial, but no autopsy was permitted.

It occurs at any age, but usually it is observed during middle life. There does not appear to be any reason to suspect

a geographical distribution, nor is there evidence that the disease is more severe at one season of the year than at another. The disease is not uncommon. Undoubtedly it was at first frequently overlooked or incorrectly diagnosed.

I observed with H. D. Geisler, a girl of ten who was supposed to have pulmonary stenosis, but whose heart at autopsy was found to be normal, undoubtedly a case of Vaquez' disease, with a red blood count that averaged about 8,000,000. This was before the publication of Osler's paper.

An interesting feature of the disease that suggests family tendency is the occurrence of fairly high red blood counts in other members of the patient's family, usually not associated with any abnormal symptoms.

The most characteristic feature of the disease is the cyanosis. This is hardly a slatey blue but rather a light purple color, involving particularly the face and hands, being deeper at the ends of the fingers and tips of the ears. The extremities are usually cold and often slightly moist. One of the features is the reddish or purplish discoloration of the conjunctivæ, which is often the most striking feature.

The patients complain of a variety of symptoms. Perhaps the most common is an indefinite discomfort which they cannot clearly describe. In addition there is dizziness, headache, tinnitus, nausea, and sometimes vomiting. There may be some disturbance of vision. Backache is not uncommon, and it has been observed that occasional paroxysms of pain in the back have been followed by hematuria, similar to the paroxysms of backache followed by hematuria that are observed in Banti's disease. In addition I have observed in one case, agonizing pain involving the pelvic girdle, and extending into the legs, not relieved by any remedies excepting very large doses of morphine.

The physical examination shows the peculiar color already mentioned, the mucous membranes of the mouth being dark red or mahogany in color. The subcutaneous veins are often distinct, especially on the face. The respirations are often slightly above normal. The breath sounds as a rule are clear, no râles being heard at the bases. This is not always the case, for if the patient seems unusually weak and depressed, basal subcrepitant râles may occur.

The heart is usually normal although there is no reason why a complicating peri or endocarditis should not be present. In one of my cases complete obliterative pericarditis was recognized during life and found at autopsy. The pulse is slightly increased in rate. Unless there is some complication, the blood-pressure remains normal. The lower edge of the liver can be palpated. If the kidneys are palpable, it is an accidental complication and has nothing to do with the disease. The spleen is large, indeed may be as large as in a severe case of leukemia. I observed one patient, a woman in her fifties, whose spleen extended to the crest of the ilium. As in leukemia, the spleen may be made to vary considerably in size as the result of treatment. As a rule, there is slight polyuria. Nocturia in older persons may be regarded rather as a complication than as a characteristic of the disease. Very often there are albumin and casts, and red blood cells in the urine. Apparently, however, the function of the kidneys is but little disturbed. The feces may also contain occult blood or red blood cells, and occasionally slight disturbances indicating transitory lesions in the central nervous system are noted.

The characteristic changes are in the blood. The number of red blood cells per cubic millimeter is increased. The bulk of the red blood cells per cubic millimeter is also increased. There is some reason to suppose that there is an actual increase in the total quantity of blood in the body. The red blood count may vary from 7 to 12,000,000. There is some doubt whether the counts higher than these that have been recorded can possibly be correct, as the bulk of the corpuscles would then exceed one cubic millimeter. The hemoglobin ranges from 100 to 150 per cent., and higher figures have also been recorded.

The white blood cells are usually increased, and the percentual increase is greatest in the polymorphonuclear cells. There is no other consistent variation in the white cell picture.

The red cells are normal in size and shape. Nucleated cells are very rarely found. There is no excess of reticulated cells. It is said that the blood has increased viscosity, but the methods that we have of testing the viscosity are un-

certain and not available for general clinical use. The fragility of the cells is normal.

It is said that the basal metabolism is slightly increased.

Only one pathological finding is of significance—the bone marrow is of the fetal type, otherwise there is simply vascular congestion of all of the organs.

Nothing has heretofore been found that explains the nature of the disease. The diagnosis is easily made, if suspected. The prognosis is hopeless for cure. Remissions may occur spontaneously, but particularly as the result of treatment. The course is chronic. For long periods it may not even be progressive. The disease rarely kills. The treatment is unsatisfactory. In one case under my care for several years, the application of radium to the spleen was invariably followed by a reduction to normal of the number of red blood cells, and the shrinking of the spleen from the crest of the ilium to a position above the lower costal margin. This patient exhibited to an extreme degree the irritability which is a common manifestation of the disease.

In other cases the x-ray is said to have done good. No form of radio activity can be regarded as a specific. It must be remembered, however, that this treatment must be administered by an expert, and continued for a long period of time. The mere casual exposure to x-rays is fore-doomed to failure. Of the other remedies that have been used, iodides have been given, and seem to me to have done good, at least patients have not grown notably worse during their administration. Benzol has also been recommended, but apparently has not been employed extensively. Venesection undoubtedly gives temporary relief, but it is only temporary.

These patients are usually sluggish, are inclined to sleep, and probably do well if they lead quiet lives, and are shielded from exposure and exertion. Splenectomy has been tried, but apparently is injurious.

PURPURA HEMORRHAGICA.

Purpura hemorrhagica is a disease characterized by hemorrhages from the mucous membranes and into the mucous membranes and the skin. The etiology is unknown. It oc-

curs suddenly and may continue for some time, and is often remittent. It is certainly due to some defect in the megacaryocytes which causes them to cease producing the blood platelets. This is functional, for under the influence of a suitable stimulus, the formation of platelets is renewed and the disease is arrested.

The *cause* of the inactivity of the megacaryocytes is unknown. Various conditions, such as infections, may precede an attack, or no obvious change. It has some features in common with aplastic anemia and lymphatic leukemia, but this fact adds nothing to our knowledge. It is not associated with any so-called diathesis or peculiarity of anatomical structure. Petechial eruptions in the skin occur in the course of certain severe infections, such as infectious endocarditis, typhus fever and smallpox, and occasionally in others, such as black measles.

The *symptoms* and signs vary according to the severity and type of the case. The symptoms may be absent or nothing more than a tingling in the skin or a sense of tension in the mucous membranes, or they may be severe, with pain in the joints and soreness in the mouth. Sometimes fever is present. The characteristic sign is the hemorrhage. This may be variable. In the mildest form the skin may show only a few small spots that do not disappear upon pressure. These spots at first are bright red, then become darker and change to yellow before they fade entirely away.

In the more severe cases the spots may coalesce, and occasionally blebs filled with black fluid blood may appear. The mucous membranes are more severely affected. Oozing occurs from the gingival surfaces, from the mucous membranes of the cheeks, and of the palate. Particularly on the palate large submucous extravasations may occur. The loss of blood from the mucous membranes may be so great that a severe secondary anemia may occur.

Whether the usual form of purpura hemorrhagica is distinct from the other forms, with visceral and arthritic symptoms need not be discussed here. At any rate the apparently characteristic lesion, the disappearance of the platelets from the blood, is not always present in these.

The *course* is variable, it may be brief, persistent, or intermittent; there is no satisfactory explanation of these varieties nor is there any sharp line of demarcation between them. The prognosis is favorable provided the proper treatment can be used.

The *treatment* can best be described from a typical case. The patient was a man thirty-five years of age, he was seen after he had been sick five days with oozing from the gums, a purpuric eruption upon the skin and sharp brief pains in the abdomen.

A systolic murmur was heard over the heart, there was slight tenderness over the abdomen. The spleen was palpable beneath the costal margin. The red blood cell count was 4,650,000, white blood cell count was 15,000, the polymorphonuclear cells were eighty-six per cent. There were no platelets. The urine was bloody. The coagulation time was normal, three minutes, the bleeding prolonged, the clot did not retreat. This patient was given 10 c.c. of a coagulant hypodermatically, and calcium by the mouth. He stopped bleeding in forty-eight hours. Ten platelets by large power field were found in the blood. Eight days later the bleeding recommenced, no platelets were found in the blood, he was transfused from his wife, 300 c.c. being used, and the bleeding stopped. Three days later 640,000 platelets were found per cubic millimeter of blood, and he recovered permanently. In these cases transfusion is a specific; it is more successful in purpura hemorrhagica than in any other disease.

Diseases of the Eye

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Diseases of the Eye.

FOREWORD.

IN the present section it was regarded as advisable to disregard certain rare or unusual conditions pertaining to various ocular structures that would be, in a sense, pertinent to this volume. Instead, attention has been given to those conditions which are frequently encountered and to which more attention, with propriety, might be given by the average practitioner.

Excluding the congenital anomalies, direct contamination of the conjunctival sac, the effects of radiant energy, refractive errors, neoplasms and conditions resulting from trauma, practically all of the manifestations encountered in ophthalmology are secondary to pathologic changes in adjacent or distant structures. It is true that as yet it cannot be definitely stated that the ordinary senile cataract should be so regarded, but we have passed the stage where this is to be regarded as a physiologic process. Even the refraction, through the ciliary muscle and the various media, may be influenced by general or distant conditions, while a certain number of the new growths are metastatic.

These facts are generally known, but all too frequently the attitude of the practitioner toward the eyes does not seem to substantiate a full realization of them. I may be pardoned, therefore, if I ask the reader to consider the relationship of the eye to the cerebrospinal system, of which, certain of its structures are in a sense a part, the fact that it may be affected by diseases of the respiratory tract, especially the upper portion; diseases of the gastrointestinal and genitourinary tracts; the cardiovascular system, as well as diseases of the blood; the endocrins; disease of the skin; the exanthemata; certain general conditions such as tuberculosis and syphilis and the metabolic conditions, diabetes, gout and rheumatism; even the osseous and muscular structures and certain parasitic

diseases are not exempt. Is there any other organ subject to such widespread influences that lends itself so readily to inspection and palpation and at the same time permits of a minute and thorough examination of its interior, where, by direct inspection, certain of the nervous, vascular, and other elements are seen under a magnification of about fourteen diameters? The fact that the ocular findings, in many instances, cannot be so classified as to make them referable to this or that particular structure, in no sense mitigates against the value of such examinations; the same thing pertains to other organs and often to a greater degree.

Two important facts may be emphasized: First, that in medical, surgical, and neurological conditions, the ocular findings are to be regarded in the light of data that must be considered in conjunction with the other clinical and laboratory findings. Second, in a certain sense it may be said that, in most instances an individual with a diseased eye is just as much a sick patient as is the individual with a diseased heart or kidney, and it is the patient and not the diseased organ alone that should be treated.

PRESBYOPIA. •

The most constant of all the ocular changes of middle life are those dependent upon the gradual failure of the accommodation, which, in the majority of cases, is evident from the age of forty to forty-five years. By accommodation we mean the adaptation of the refraction of the eye for different distances, that is, between infinity and its so-called near point.

While different theories have been advocated to explain this function the one most generally accepted is that offered by Helmholtz. Briefly stated, the ciliary muscle contracts and in doing so relaxes the suspensory ligament or zonula of the lens. Thus released from its tension, the pliable and elastic lens becomes more convex anteriorly and posteriorly and while the anterior surface advances, pushing with it the central part of the iris, the posterior pole of the lens remains fixed.

From early childhood on through life the near point, or the closest point at which fine print can be read, has a tendency

to recede from the eye until some time in middle life when it passes beyond that particular distance from the eye where it would be serviceable for near work. For the average individual and for ordinary purposes we may regard this distance as about 28 cm. or 11 inches. The patient is then presbyopic and a special glass becomes necessary for near work.

This lessening in the accommodative power is dependent upon changes that have slowly and progressively developed in the lens substance, a hardening or sclerosis, which is most marked in the central portion. Thus, with the lessening of the elasticity of the lens its inherent power of increasing its own convexity diminishes and as a result, the near point of the eye gradually recedes more and more. I also believe that there is some lessening in the power of the ciliary muscle. With this in mind, it is evident that when we give an additional glass for reading or near work we merely compensate extraocularly for a loss of function; that is, we place in front of the eye a convex glass; in youth the elasticity of the lens itself permitted it to become sufficiently convex.

From what has been said it may be inferred that one of the first signs of presbyopia is the greater distance from the eye that a printed page must be held to be seen clearly. While such procedure increases the definition, it also makes the type appear smaller. Not infrequently women will complain of the difficulty of seeing the eye of a needle. For well known optical reasons, such eyes see better when the pupils are contracted and as a consequence reading at night becomes difficult unless the light is so placed that it falls directly on the eyes and thus causes a contraction of the pupils. This is frequently resorted to and subjects the individual to the additional inconvenience and hazards of faulty illumination.

While pain and other signs of accommodative strain are not as a rule complained of, under certain conditions they may be present. The individual with head slightly thrown back, arms extended, making frequent, short, to and fro shifts in the position of the page, "tromboning", as it is sometimes called; or, the woman holding her needle with extended arm, chin elevated and at times, face averted, making repeated and futile

thrusts at the eye of her needle with a thread, afford pictures too familiar to be dwelt upon.

This failure of the accommodation may be readily determined by first finding the near point and for this purpose a simple test is always at hand. If the usual reading test card is not available, fine print, of about this size, ^{and did not want richer furniture.} ^{There were three other apartments; one for my wife and me, another for our two daughters within} or slightly larger, may be selected from any text at hand. One eye is covered while the test type is slowly carried towards the eye until the print is indistinct, but can still be read. The distance from the print to the cornea is then measured and recorded. Instead of fine print, a fine black line, a sixth of an inch in length, may be made on a white card by a light stroke of a pen. This is made to approach the eye under examination until the line becomes indistinct or there is a tendency to doubling. The distance from the eye is then measured as above described. From what has been said it may be judged that the same individual might be presbyopic at a much earlier age if it is necessary to do near work at nine inches, than would be the case if the near work could be done at fourteen or even eighteen inches. The following table shows the distances of the near-point from the normal eye at different ages:

35 years	.....	18	cm.	.....	7	inches
40 "	.....	22	"	.....	8¾	"
45 "	.....	29	"	.....	11½	"
50 "	.....	40	"	.....	15¾	"
55 "	.....	55	"	.....	21½	"
60 "	.....	100	"	.....	39½	"

In other words, every individual with normal eyes who attains old age must wear glasses for near work in the later years of life if he desires to see properly, and this irrespective of any cherished scientific or other beliefs that he or she may foster.

So far, only what might be regarded as physiologic changes in the normal eye have been referred to. The refraction of the eye, whether hyperopic or myopic, also has a determining influence on the onset of presbyopia. Thus the focus of the lens system or dioptric apparatus of the farsighted or short eye is behind the retina and an individual with such a hyper-

opic eye may, and invariably does, correct his hyperopia, by accommodating, unless it be of an excessive amount. This constant use of part of his accommodation to maintain good distant vision leaves just that much less power available for his close work and as a consequence his near point is further from the eye than is that of the individual of the same age with a normal or emmetropic eye. In other words, presbyopia develops earlier in the hyperopic eye. On the other hand, in myopia the accommodation cannot be utilized to improve the distant vision because the focus of the dioptric apparatus of the near-sighted eye is in front of the retina and as a consequence all eyes of this type have defective distant vision. However, it has this compensation, that with its short focus, an object at some point inside of infinity can form a clear image on the retina without utilizing the accommodation, which leaves all of this function intact for distances nearer the eye. Thus, a myope of moderate degree, say three diopters, with his eye at rest, would have a clear image formed on his retina when the object was placed at 33 cm. or 13 inches in front of the eye. To accomplish the same result an emmetropic or normal eye would be compelled to accommodate three diopters, and it would necessitate six diopters of accommodation in the case of a hyperopic eye of three diopters. It is thus seen that with three diopters of myopia an individual has all of his accommodative power available for use within 33 cm. or 13 inches of his eye and consequently can see objects, such as fine print, closer to the eye than can an emmetropic or hyperopic individual of the same age.

Mention must also be made of those instances where certain anomalies of accommodation exist; these Duane has classified as excessive accommodation; insufficiency of accommodation, inequality of accommodation and ill sustained accommodation, terms that are sufficiently explanatory; finally inertia of accommodation, where there exists some difficulty of changing from one state or stage of refraction to another. Needless to say the first two of these would have an important bearing on presbyopia. The insufficiency cases dependent upon weakness of the ciliary muscle may be the result of an ocular condition such as glaucoma, or certain general conditions such as neurasthenia, nasal disorders, increased blood-

pressure, disturbances of the endocrins and various toxemias. In many of these cases definite asthenopic symptoms are present.

The *treatment* of this condition need not be discussed in a volume of this character, but a word may be said about myopic individuals and presbyopia. Through a misunderstanding many believe that because they are myopic, glasses for near work will not be necessary in the later years of life. This is true in certain instances where the myopia is of moderate degree, but it does not hold true in certain other instances where the amount of myopia is small or possibly where it is excessive.

RETINAL VASCULAR CHANGES ASSOCIATED WITH HYPERPIESIA, ARTERIOSCLEROSIS AND NEPHRITIS.

These cases showing retinal vascular changes with or without ophthalmoscopic alteration in the optic nerve and retina, form not only a definite percentage of the cases coming under the observation of the ophthalmic clinician, but they also constitute a most interesting group. As certain vascular symptoms may suggest to such patients that their eyes are at fault or because early signs of retinal vascular changes are prone to develop about the time an individual comes under observation for presbyopia, many of these cases are first seen by the oculist. Like many other eye conditions that from an ocular standpoint may be regarded as primary, they are really secondary, and for their proper and successful handling and treatment, should have the coöperation of the internist. On the other hand, I believe it is just as truly appreciated by the internist that no case of vascular or cardio-vasculo-renal disease has been properly studied unless an ocular examination has been made. Combined efforts should not cease after a diagnosis has been determined, but should continue throughout the course of the observations. This is the only way proper correlation can be maintained to advantage.

It is well recognized that sclerosis of the retinal vessels is apt to be associated with a similar condition of the cerebral vessels and that these changes as revealed by the ophthalmo-

scope may be decidedly out of proportion to evidences of arterial changes elsewhere. On the other hand, retinal changes may be but slight, and definite symptoms of a systemic sclerosis exist; or, as Hertel has pointed out, the retinal vessels at times show arteriosclerotic changes microscopically when none can be discerned ophthalmoscopically.

While in recent years attempts have been made to type the fundus manifestations according to various vascular or vasculo-renal conditions, owing to the many still obscure and disputed questions pertaining to the organs involved, the fact that certain of the intraocular changes are common to all types, if we possibly exclude certain cases of acute nephritis, the border lines as we change from one condition to another are rather broad. It is with this in mind, that I have mentioned the importance of repeated ocular examination so that the changes, whether progressive or not, may be watched and early evidences of new manifestations studied. It is the onset, extent, or sudden augmentation of certain lesions and the grouping of the various signs, more than the mere existence of these signs that, taken in conjunction with the clinical findings of the internist and the laboratory reports, go to build up the true clinical picture. Every experienced ophthalmic clinician is constantly encountering instances where shortly following the detection of these intraocular vascular signs, central vascular disturbances develop; or, where certain manifestations have been present, the explosion of fresh or new signs has indicated a rise of pressure or possibly a renal insufficiency.

A clearer conception of the underlying complex vasculo-renal problem will ultimately admit of adequate classification of these intraocular signs, until then they remain in a sense as suggestive. The path between suggestion prompted by accurate and careful clinical observation and laboratory corroboration, is frequently a long and tortuous one, but this in no sense robs either of its value; as is shown by the present day status of medicine.

Etiology. As to the etiology of hypertension, arteriosclerosis without and with associated renal conditions and nephritis, the reader is respectfully referred to the sections by Dr.

Piersol (pages 393 to 417) and that of Dr. Pepper (pages 605 to 609).

Symptoms. While Hirschberg, Raehlmann, and in this country Friedenwald, made early observations on the retinal changes seen in arteriosclerosis, Gunn's excellent contribution in 1898, in which he described the lesions present in cases of increased tension in arterial disease with and without albuminuria, was doubtless the factor that stimulated a more widespread study of this subject. It was followed in this country by a number of excellent contributions, notably by de Schweinitz.

In arteriosclerosis with increased tension certain signs were regarded as suggestive, to which were added others believed to be pathognomonic. The suggestive signs were the light color of the arteries with an increase of the light streak, associated with some tortuosity and irregularity in calibre; changes in the course and calibre of the veins. Later the pathognomonic signs appeared in the form of further changes in the arteries where there was a loss in the translucency and a beaded appearance might develop; lesions in the vessel walls gave rise to white stripes along the vessels, constituting the so-called periarteritis. The veins likewise showed further irregularity in calibre and in places revealed a flattening, definite indentation, or constriction where pressed upon by an overlying rigid artery. Evidences of obstruction might also be present in the affected vein, distal to the point of compression, as manifested by a localized dilatation. As with the arteries, white lateral stripes might develop along the veins, a periphlebitis. Linear or flame-shaped hemorrhages developed in the retina and more or less edema might be present about the disc or along the course of the vessels.

De Schweinitz further emphasized that three signs may be noted early, namely, a cork-screw appearance of certain arterial twigs, the crinkled retinal vessel of Alleman, apt to be noted about the macular region or arising from some medium sized vessels of normal appearance; the flattened or indented vein and finally a congested appearance of the nerve head. He differentiated the last sign from the appearance of the disc in the hyperopic eye and in the early stage of neuritis.

During the past fifteen years our increasing knowledge of vasculo-renal disease and more thorough study of these vascular fundus changes have made it possible to attempt further classification of these signs, but in well advanced vasculo-renal cases any or all of the above mentioned changes may be seen. Thus Moore, recording his observations in 1916, may be said to have instigated another wave of interest, and this has been followed by numerous other contributions.

HYPERPIESIA.

This condition may be indicated, according to Benedict, by an increased tortuosity of the artery which becomes copper colored through loss of translucency in its walls. The light streak is narrowed and intensified and venous indentation by the overlying artery occurs. As the condition persists and as the result of thickening of the intima and middle coat, the artery contracts and the curves and bends are straightened out. Further indentation of the veins occurs with possible localized dilatation distal to the point of compression. The veins become two to three times the diameter of the arteries. A few white dots may be scattered about the posterior pole and some edema may be present.

Adams emphasizes the disappearance of the venous reflex stripe for a short distance on either side of the point of arterial crossing, while Bardsley believes that early the vessels are uniformly full with a broadened and increased intensity of the light streak. In an individual case seen for the first time, the changes in the course of the arteries above described would be of but little service, owing to the variations of the physiologic limits.

ARTERIOSCLEROSIS WITH HIGH TENSION.

In these cases the copper colored arteries show a narrowed and intensified light streak and at times the cork-screw terminals may be seen. There are present the manifestations above referred to, depending upon a crossing of the arteries and veins. At times one may note a contraction of a vein between two near points of arterial crossing.

Moore emphasizes the frequently seen instances of the displaced line of the vein near the point of crossing in the severer

types. Instead of maintaining its oblique course as it passes under the artery, it is deviated and may parallel it for a short distance before and after crossing or may cross at right angles. As pointed out by de Schweinitz, the nervehead may present a more or less characteristic congested appearance. While in my experience it is not always evident when other signs may be quite well marked, I have seen it exist when it seemed to be out of proportion to the other signs. I have noted it to best advantage in those well marked cases in association with nephritis. Irregularity in the calibre of the arteries is frequently seen in a varying degree and in the case with well developed signs the so-called "silver-wire" arteries may be present.

Perivasculitis may be noted along certain vessels, in fact, an artery may be entirely replaced by a white cord which extends far into the periphery of the eyeground. Over the central portions of the fundus may be noted small hemorrhages, usually of the linear or flame-shaped type. Unless nephritis be present widespread edema is absent, although discrete areas have been observed. Aside from the solitary dilated and tortuous vascular twigs, one at times sees in the advanced cases, usually about the macular region, masses of these tiny convoluted vessels, marked enough to give one the impression of a glomerulus of the kidney. I have observed in several instances that these vascular convolutions were apparently the point of origin of extensive hemorrhages. More rarely evidences of proliferative tissue will be seen, but in my experience this is usually more frequent in the associated nephritis cases.

Moore believed the term arteriosclerotic retinitis should be applied to those cases in which there develops in addition to the vascular changes, small, discrete, irregularly circular whitish exudates, essentially chronic in character and apt to be grouped about the posterior pole. They may be associated with central larger lesions of dirty-white appearance, but hemorrhages and edema are not present about them. He also comments upon the occurrence of localized white plaques or pipe-stem casing of the arteries that have been described by Hulke.

RENAL DISEASE.

In those cases where a chronic nephritis exists the disc may present various manifestations. We may find but slight injection or a brick-red disc, at times a partial or complete blurring of the margin with delicate striations and more or less adjacent edema of the retina, constituting the so-called neuroretinitis. Less frequently one encounters a definite choking, which it would be impossible to differentiate from that seen in brain tumor. More or less edema is frequently present, in fact Slocum in his interesting study from the service of Dr. W. R. Parker, found it present in 93 per cent. of his cases. Discrete yellow white or soft edged white spots are not infrequently seen about the disc or macular region and when they cover larger areas are sometimes designated as "snow banks". Of the macular changes that occur the most conspicuous is the stellate figure which for years has been recognized as one of the distinguishing features. When well developed it constitutes a striking picture but it is questionable whether it is seen as frequently as the knowledge of its possibility would seem to indicate. In Slocum's series it was present in 6.8 per cent. of the cases. Concerning this lesion, it must be remembered that it is not pathognomonic. It is not infrequently seen in brain-tumor cases, has been observed in syphilis independent of nephritis, and personally I have seen two instances of double perforation of the globe by a foreign body, the posterior wound being at the border of the macular region, where typical macular stellate figures developed. When incomplete, in both nephritis and brain tumor, the radiations that exist almost invariably extend from the macula towards the disc.

Needless to say the vascular signs already described are present in varying degrees and in long continued cases are apt to be excessive. In Slocum's series, hemorrhages were present in the "interstitial cases" in 73 per cent. and 50 per cent. in those of "chronic nephritis." These may be of the linear, flame-shaped, or larger solitary type but at times the rosette is encountered. I have seen such a hemorrhage give rise to a central scotoma. Pepper has recently emphasized the importance of hypertension as a causal factor in the purely

vascular as well as the nephritis cases. Needless to say in certain types of retinitis the vascular signs seem to predominate, in others, the exudative.

Acute nephritis, as seen in pregnancy, infections or certain intoxications is not particularly pertinent, unless engrafted upon pre-existing vascular disease. Under these circumstances we might expect the development of fresh exudative lesions and probably fresh hemorrhagic extravasations.

The extent to which certain of the signs may be dependent upon high blood-pressure, arteriosclerotic changes in the vessel walls or faulty renal elimination, has been freely discussed and variously interpreted, but with our present knowledge, if we eliminate probability, the fact remains, that we do not know.

Certain complications may develop in these vasculo-renal cases in the form of retinal detachment, thrombosis of the retinal vein or artery, embolus of the retinal artery, hemorrhage into the vitreous, and finally glaucoma.

While it is true that statistics show that the majority of patients with renal retinitis die within two years, a small number live three or four times that period. One of my own cases of vasculo-renal disease, survived at least five years after she was first seen, and at that time there existed the most widespread and extensive involvement.

DIABETIC RETINITIS.

Closely allied in its appearance to the renal type is the retinitis of diabetes. Some clinicians regard it as rare, in my experience uncommon would be a more appropriate term. It is seldom seen before the age of forty and is more apt to develop in those cases with a low or moderate glycosuria.

Hirschberg classified the manifestations into exudative and hemorrhagic types and alluded to certain other mixed forms. In the first type small discrete white spots, rather sharply circumscribed and opaque, are scattered about the disc and macular region. A few small hemorrhages are also present. Numerous hemorrhagic extravasations constitute the conspicuous and predominating lesions in the hemorrhagic form. In other types there may be present more widespread whitish

or ivory white exudations and these may be associated with haziness or blurring of the disc margins. Vitreous opacities as well as hemorrhage into the vitreous may occur, and in the latter instance glaucoma may develop. Excluding the existence of ocular or retro-bulbar complications, the vision is affected in accordance with the extent of macular involvement.

Hirschberg and subsequent writers have noted the frequency with which the manifestations are apt to be associated with sclerosis of the retinal vessels. In 1920 Garrod stated that while the retinitis of diabetes can be distinguished from that of renal disease, high blood-pressure and arterial changes are probable factors in both and the metabolic factor may be supposed to determine the difference in the fundus changes. In 1921 Wagener and Wilder placed on record their findings in 44 cases with retinal disturbance observed among 300 patients with diabetes. Those showing fundus manifestations were invariably the patients with milder types of the disease and with associated vascular changes.

While I believe most clinicians have correctly diagnosed diabetes from the fundus picture, on the other hand the fact remains that there are types where a differentiation between a diabetic and renal retinitis is impossible.

Lipemia retinalis, characterized by a dilatation of the retinal vessels with changes in their color varying from a salmon pink to a grayish-white, need not be dwelt upon. Comparatively few cases are on record but it is possible that a number have been overlooked or missed, especially when the manifestations have been of but short duration. In the majority of instances the patients have been under thirty years of age. It was first described by Heyl in 1880 and has been fully described in recent papers by Hardy and McGuire.

Blood-Pressure in the Central Retinal Artery. As far as I am aware Henderson in 1914, during his interesting work concerning the relation of the intraocular tension to the intraocular venous level, was the first to devise an instrument to measure the arterial diastolic pressure within the eye. He found the pressure to be 15 to 25 mm. Hg above the intraocular pressure. Since then Bailliart has devised a new instrument and has been making further observations on normal eyes and in certain pathologic conditions. As the result of

these investigations he has placed the normal systolic pressure of the central artery of the retina at 70 to 80 mm. Hg and the diastolic at 30. While these studies are still more or less in the experimental stages they give promise of throwing new light upon certain intraocular conditions.

CATARACT.

Of the many types of cataract, the one most frequently seen, the so-called senile, is the one that pertains particularly to this volume. For clinical purposes it is frequently designated by various descriptive terms depending upon the site of the opacity, the degree of opacification and the color. In the first instance the terms sub-capsular, cortical, nuclear or capsulo-lenticular seem sufficiently explicit and the same may be said about the terms incipient, immature, mature or ripe, and hypermature. The degree of sclerosis of the lens has an influence upon the color. The white cataract is most frequently seen in younger individuals. In the senile form the gray type is frequently observed and at times it assumes a mother-of-pearl appearance. In other instances the nucleus gives it an amber tint, although darker tints, even to the so-called black cataract, are also observed.

Inasmuch as the nucleus is well formed in the senile type it is designated a hard cataract in contradistinction to the soft variety seen under the approximate age of thirty-five and the fluid or Morgagnian cataract, which may develop when the lens becomes hypermature.

Etiology and Pathogenesis. The lens is a transparent elastic mass composed of an innumerable number of fibers which develop from the epithelium lining the anterior capsule. Towards middle life a nucleus develops as the result of a sclerosis of the more centrally placed fibers. Thus, from this time on the lens shows centrally, in the form of the nucleus, what may be regarded as a physiologic retrograde process, while a new growth of fibers from the capsular epithelium continues to form about it until late in life. The transparency must persist and growth continue if it is to carry on its function properly.

While the nutrition of the lens doubtless depends upon the intraocular fluid and in turn the blood, we are practically in ignorance as to the exact essentials necessary for proper nutrition as well as the metabolism of the cells. In fact our knowledge is by no means as complete as it should be concerning the composition of the intraocular fluid in which the lens is practically suspended. Roemer demonstrated that physiologic fluctuations of the osmotic pressure of the serum were constantly transmitted to the aqueous and he believed the lens to be adapted to its surrounding medium in the same way as the blood-cell to the blood serum. Burdon-Cooper whose recent contributions to the subject have been so conspicuous, studied the surface tension of the aqueous in senile cataract and found that it approximated more to that of water than in the normal eye, and as a consequence he believes there is a more rapid interchange between the lens and aqueous in the presence of cataractous changes than in the normal metabolism.

Most authorities now concede that the anterior surface of the lens is the portion most concerned with nutrition and Roemer and Burdon-Cooper practically agree that the nutrition is maintained by three factors; an osmosis of the intraocular fluid, a slow diffusion between and slow inhibition by the individual cells and finally a specific affinity of its protoplasm.

The older hypotheses dealt mostly with conditions pertaining to the lens while certain diseases with which cataract was frequently associated were discussed as probable factors. In more recent years with the further advances in biochemic studies and further research concerning the physical properties of light, other hypotheses have been evolved.

Becker in 1876 stated that an irregular sclerosis of the lens nucleus brought about changes in the adjacent layers of the lens; later Deutschmann accepted the same theory believing that the water given off during the process of sclerosis caused swelling of the lens fibers. Magnus thought that the sclerosis brought about a stasis in certain portions of the lens as the result of interference with the nutritive currents. Schoen regarded as a factor, the tugging of the zonular fibers on the capsule of the lens during accommodation, believing

that it first produced changes in the capsular epithelium and later in the lens itself. Hess, who has given so much time to the study of the lens, questioned each of these hypotheses.

For years many clinicians have believed that hyperopia and uncorrected astigmatic errors especially of the oblique or against the rule type, predisposed to the development of cataract. In support of this Burdon-Cooper recently has made emphatic corroborative statements. It is his belief that an important factor is the "irregular torsional accommodation effort which produces an irregularity in lens shape and alteration in the axis" as this occurs in hyperopic astigmatism. As the result of this uncorrected strain on the suspensory ligament and the lens capsule, cataractous changes may develop. He strongly urges the correction of refractive errors as a prophylactic measure. This irregular torsional accommodation brings up the old question of astigmatic accommodation first introduced by Dobrowolsky and while the theory has many supporters, others have never accepted it.

The occurrence of cataract with certain general diseases has long been recognized and the association of lenticular changes with arteriosclerosis has been referred to frequently. Thus v.Michel thought that sclerotic changes in the carotid and its distribution might be responsible for the difference in time of the onset of the changes in the two eyes. Certain other observers felt that there existed some relation through changes in the vessels supplying the so-called secretory apparatus, but no direct relation has been traced and Gunn believed that none existed. How much certain of the uncorrected toxemias that seem to predispose to arteriosclerosis may act as inciting factors is of course conjectural, but it is not beyond reason to imagine that they may be contributory.

For years the association of nephritis and cataract has been recognized but despite considerable investigation no direct connection has been assumed by many observers and Groenouw does not regard cataract as more frequent among nephritis cases. On the other hand, Burdon-Cooper after referring to the findings of Frenkel that the insufficiency of the kidney in cataract cases is not accompanied by the usual clinical symptoms, but still admits of the accumulation of cytotoxins, states, that his own experience with these cases point

to a definite renal inefficiency, as is manifested by a larger increase in tyrosin in the lens and the resemblance in the variations of the molecular concentration and surface tension of the aqueous and similar constants of the urine.

While certain of the infectious diseases might not be pertinent to the senile type, mention might be made of the association of cataract with hook-worm diseases as cited by the elder Calhoun and his son, J. Phinizy Calhoun. Welton and Whaley have also referred to its presence in twelve and sixteen per cent. of the cases of pellagra that came under their observation.

Peters, from his researches, believed there must be a higher molecular concentration in the lens than in the anterior chamber and that this is regulated by the epithelium of the lens. Any increase in the molecular concentration in the aqueous would be detrimental to the lens by interference with the osmotic exchange and in turn with its normal nutrition. To these views Roemer and Burdon-Cooper do not subscribe.

Roemer's theory, which is one of the most interesting of modern hypotheses, is that the subcapsular, the most common of the senile type, is a true metabolic disease of the lens. It was not thought that lack of nutrition alone explained it. He believed that senile involution anti-bodies originated in the blood which possessed a specific affinity for some constituent of the lens protoplasm. If these were not excluded by the secretory apparatus of the eye then the lens might be impaired by the fixation of these abnormal products of metabolism with corresponding receptors of the protoplasm, just as a blood-cell may suffer through fixation of a specific cytotoxin. Thus, he attributed the cataractous changes to a cytotoxin effect upon the epithelium and lens fibers. He believed that when nuclear cataract is associated with the subcapsular type, two different processes are concerned.

As the result of Burdon-Cooper's admirable and painstaking work on the lens, he believes that the cataractous changes are brought about as the result of hydrolysis, which he defines as "a simple decomposition resulting from the assimilation by the proteid molecule of the lens of the constituents of a molecule of water . . . with the production of new substances." He states this theory would explain his finding

of tyrosin in the aqueous after needling the lens and its presence in the aqueous and lens in senile cataract; the much increased amount of tyrosin in the lens and aqueous in both albuminuria and glycosuria. Further, it is the only theory which accounts for black cataract and pigmentation of the lens and the diminution in the weight of cataractous lenses. It would also explain the frequency of cortical opacities and the observation of Dor that the lental albumin is much less and sometimes disappears, because it is hydrolysed and carried away by the aqueous.

In recent years the endocrins have not escaped suspicion, Vossius and Schiötz referring to them as causal factors. Triebenstein and Fisher have discussed the possible influence of the parathyroids on senile cataract and comment on the frequent occurrence of latent signs of tetany in these cataractous patients. On the other hand, Hescheler found but two per cent. of his cases so affected. Gjessing suggests that pregnancy and lactation may have a slight contributing influence through abeyance of the ovarian function.

The influence of heredity, so thoroughly studied by Nettleship, in the production of lenticular changes is unquestionable as many observations have shown, and as I have seen in a number of instances in the congenital type at the Overbrook School for the Blind and elsewhere. Heredity influences the onset of cataract in later years but in just what way remains unknown.

The influence of light rays on the production of cataract has attracted considerable attention in recent years. Handmann, from his study of a large series of incipient cataracts, found that the process began in the lower nasal quadrant and while he believed that through gravity this would tend to support his view that nutritional influences were responsible, he also pointed out that this portion of the lens was subjected to the greater effects of light. To the latter suggestion Hess and others have taken exception. The same year Schanz and Stockhausen after experiments with human lens substance exposed to prismatic light, thought the incipient changes noted in old age might be dependent upon the absorption of ultraviolet rays over a long period of time. Later Schanz stated that the portions of the lens protected by the iris were

affected by the rays being reflected from one surface of the lens to another, and that in addition to chemical influences, absorption, reflection and diffusion were also factors.

Burge, from his studies with the quartz-mercury vapor lamp, believes that in senile and diabetic cataract two factors are active; (*a*) a modification of the lens protein and (*b*) its coagulation by the short wave radiations. As to the dangers of ultraviolet rays from artificial light, Verhoeff, Bell and Walker have pointed out that a glass globe is sufficient to eliminate their danger.

Inasmuch as certain types of cataract that may be regarded as industrial are prone to develop about middle age, these may be briefly commented on; I refer to those seen in bottle-makers, blacksmiths, tinplate millmen, chain workers, etc. Light, heat, the ultraviolet and the infra-red rays have all been regarded as factors either alone or in combination and despite considerable research, especially in England and Germany, the question is still an open one. It would seem that in recent years less emphasis has been placed upon the ultraviolet rays and more upon the infra-red and that heat is one of the possible factors concerned.

While diabetes as a cause of cataract has been well established, it is now generally conceded that it is only in young individuals that we can properly designate a cataract as definitely diabetic. In the later years it may be impossible to differentiate it from the ordinary senile type, so that cataract in association with diabetes is a preferable way to refer to it. The presence of sugar in the aqueous has been shown to be too small in amount, even in the presence of seven to eight per cent. of sugar in the urine, to act as a definite factor. Others have attributed it to the changes produced by diabetes in the retinal pigment layer of the iris which have been described by various observers. These changes may be indicated at the time of operation by seeing the anterior chamber flooded with an inky fluid at the time an iridectomy is done. This occurred with a patient I now have under observation and has been frequently noted by others. Some observers (Stricker, Botlazzie and Scalinci) have regarded it as due to an acidity of the aqueous, which is contrary to the findings of Burdon-Cooper, who believes it to be dependent upon hydrolysis of

the lens and states that in diabetes cholesterin is present in excess of the tyrosin. Roemer believed the lens was injured by specific metabolic products, in other words, he regarded his cytotoxic theory as applicable to diabetic as well as senile cataract. Langdon has recently suggested that in certain cases of senile cataract a low sugar tolerance might be a causal factor.

Symptoms. Senile cataract is generally bilateral and frequently one lens is affected more than the other. However, it is possible for one lens to become mature before changes develop in the other eye. The patient may complain of slight photophobia and lacrimation and there may be some vague discomfort but not infrequently these symptoms are absent. At times spots are noted in the field of vision and these may be described as appearing like flies or spiders and may be sufficiently distinct to be drawn. When directly looked at they do not disappear or shoot to one side of the field as do the spots due to *muscæ volitantes*.

Frequently one of the first symptoms is the gradual failure of vision. The cataractous changes may produce an irregular lenticular astigmatism and as the result a polyopia, monocular diplopia and some distortion of objects regarded may develop. In the early stages no changes can be noted in the pupillary area with the unaided eye, but as the opacification of the lens advances the pupillary area assumes a gray appearance or a yellowish or amber tint if the nucleus be much involved. The pupillary area does not give evidences of the presence of a black cataract to the unaided eye. With increasing opacification some swelling of the lens may occur with a resulting decrease in the depth of the anterior chamber. This is sometimes designated as the stage of intumescence and may be associated with a rise of the intraocular tension and definite glaucomatous symptoms. In the absence of such signs and symptoms all cases of cataract should be examined with a dilated pupil. For this purpose cocaine, euphthalmin or eucatropin may be used, after which a miotic should be instilled. With the ophthalmoscope and a +7 D. or +16 D. lens any opacity capable of intercepting the light rays will appear as a dark area surrounded by the red glare of the fundus reflex. Thus the incipient cortical cataract may show as black striæ, sectors,

dots, or bar-like opacities, usually in the periphery and extending toward the center of the lens. In the early stages the lower periphery is the portion most frequently affected. In nuclear cataract the red fundus reflex is clouded centrally, the extent and intensity of which depends upon the degree of involvement. In either instance as the process advances throughout the lens, the red fundus reflex becomes less evident until finally it is obliterated by the extent of the opacification.

Every practitioner should have in his office a condensing lens and some type of loupe. The Berger loupe is convenient and cheap. These instruments are invaluable for foreign bodies, dermatologic as well as external ocular examinations. The examination by oblique illumination is invaluable in cases of cataract. The cornea, anterior chamber and iris can be well studied, and the opacities in the lens noted and their position determined. Just as the ophthalmoscope is the only method for definitely determining a Vossius ring-shaped opacity in the lens that frequently follows ocular trauma, just so a coerulean punctate cataract can be diagnosed with certainty only by oblique illumination.

To employ this method a light is placed a foot or two to the side of the patient's head, a beam of light is then focused on the eye by means of the lens which is held between the thumb and index finger, the little finger resting upon the cheek. The eye is then observed through the loupe which has been adjusted to the head by an elastic or metal band. The other hand is free for manipulation of the upper lid should this be necessary. By this method the opacities in the lens appear gray in the otherwise black pupillary area. An immature cataract with some uninvolved cortex can be detected when the light is directed on the eye by the existence of a dark shadow which is adjacent to that portion of the pupillary margin which is nearest the light. This is caused by the shadow of the iris cast on the deeper seated opacity. The observer standing in front of the eye sees as a dark crescentic area that portion of the shadow extending beyond the pupillary margin. When the cataract is mature, this shadow cannot be formed. Those opacities in the deeper portions of the lens can best be studied if the light be directed into the pupillary area more perpen-

dicularly, that is, by having the light more directly in front of the patient. With the light so placed, membranous or large cloud-like opacities of one type or another can be detected even in the anterior portion of the vitreous, providing the media anterior to the vitreous be clear.

While it is true that any opacity in the lens may be regarded as a cataract, it should be remembered that in many instances very delicate opacities may exist for years in the periphery of the lens and give rise to but little if any visual disturbance. Frequently the progress of these lenticular changes is most irregular, they may remain stationary for considerable periods of time and then take on a more or less rapid growth, only to lapse again in their progress. In the absence of symptoms and defective vision and in the presence of faint peripheral changes in the lens it seems to me just as unwise to alarm a patient by telling him he has a cataract as it is unwise not to tell him when he has evident symptoms and a definite reduction in visual acuity unimproved by glasses. It should be more thoroughly understood, that of all the real serious intraocular conditions that may develop in the later years of life, providing it is uncomplicated, cataract is one of the most favorable, despite its possible inconvenience, for it is capable of removal with the vast majority of chances in favor of a good result.

When cataract is suspected or definitely known to exist, the patient should be seen by an ophthalmic surgeon as early as possible for it is important that he be familiar with the condition of the intraocular structures and extensive opacification of the lens prevents a study of the fundus. His prognosis, method of operation and treatment during the interval would be influenced by the conditions found, for a cataract in the later years of life may be but symptomatic of other serious intraocular changes. To wait until the vision is practically lost and the opacity well advanced is often a detriment to both patient and surgeon.

When so-called "second sight" develops late in life in a farsighted individual, it is not indicative of strong eyes as is so commonly thought by the laity, but of some pathologic condition affecting the ocular structures. The same statement may apply to myopic eyes, but not necessarily so. The

condition most frequently encountered is a swelling of the lens due to cataractous changes.

At times diabetes is capable of producing certain alterations in the media without visible evidences of cataract, that give rise to marked changes in the refraction, usually an increase in the amount of hyperopia. Wescott, Lundsgaard, Knapp, Zentmayer, Roberts and others have recorded such incidences. Whether the changes concern the lens or vitreous or possibly both is not definitely known, but it is probable that a lessening of the refractive power of the lens is at least a factor. An acromegalic patient without intraocular changes, seen by me in conjunction with Dr. Stengel, developed glycosuria. About a month later he complained of poor vision with his glasses; examination showed that he had lost practically all of his myopia, 2 D. Four months later his refraction had returned to its original condition.

Industrial types of cataract. The cataract occurring in bottle makers (Legge, Robinson) tin-plate millmen (Healy), chain-makers (Roberts), and puddlers (Cridland) is apt to develop about middle life. In the earlier stages the posterior cortical layers of the lens are most frequently involved. While the opacity is frequently seen as an irregularly disc shaped posterior central opacity, Healy in the tin-plate cases also frequently noted a wedge-shaped opacity with the base down or down and in, and in its growth it usually involved the posterior cortex. In the several cases I have seen in puddlers, the opacity has been of the posterior central irregular rosette type with a few delicate peripheral striæ. Naturally as these cases advance and the anterior cortex becomes involved, anything that might be regarded as characteristic is lost.

GLAUCOMA.

Glaucoma is a disease of the eye which may manifest itself in several different types. Increased intraocular tension is the most important sign. If, as the result of the rise of tension and irrespective of its cause, the globe is much injected from overfilling of the external vessels, we speak of acute congestive glaucoma. When there is but slight overfilling of the vessels, either as a primary condition or persisting after the

subsidence of more acute signs, it is regarded as the subacute congestive type. We also speak of a chronic, simple, or non-congestive type when certain signs and symptoms are present without external injection of the globe. Any of these varieties may develop into one of the other types during the course of the disease. When the condition develops without contributing factors, the result of previous ocular disease, it is regarded as primary. When a condition like a bound down iris promotes its onset it is designated as secondary. A juvenile type developing in childhood also occurs, while a congenital type constituting the so-called buphthalmos or hydrophthalmos is likewise recognized.

Pathogenesis, Pathology and Causes. The aqueous humor consists of about 95 per cent. water with certain extractives, the sodium chloride being rather high, and a small amount of albumin. Its formation is attributed to the ciliary body, but there still remains some question as to the particular structures concerned in its production, as well as the method of its production, that is, whether by filtration or a true secretion. Recently Magitot has entirely excluded the ciliary body and regards it as a secretion of special neurologic cells.

The aqueous passes from the ciliary body between the posterior surface of the iris and the lens, then through the pupil into the anterior chamber. Here it passes towards the angle of the chamber where it filters through the pectinate ligament into the Canal of Schlemm. Part also escapes through the pitted and spongy anterior surface of the iris. The intraocular pressure, maintained by the intraocular fluids, may be regarded as equivalent to about 25 mm. Hg, but just how this maintenance is accomplished and what factors chiefly are concerned in its disturbance still remains a problem which has not been definitely solved.

The retention theory concerning the production of glaucoma depends upon the assumption that there has been some obstruction to the outflow of the intraocular fluids, either in the posterior portion of the globe or anteriorly, especially at the angle of the anterior chamber. Thus, Knies and Weber have pointed out that in glaucoma there occurs an adhesion of the base of the iris to the posterior surface of the cornea which covers in or shuts off the filtration angle. In certain

instances this may be brought about by congestion and swelling of the ciliary body, in others by an increased size of the lens. It is a condition that develops sooner or later in practically all cases of primary glaucoma. Others, such as Laqueur and Birnbacker and Czermak have emphasized the importance of obstruction of the filtration channels about the *venæ vorticosæ*. Interruption of the posterior channels in connection with the optic nerve has also been considered. Henderson's studies have led him to believe that a sclerosis of the pectinate or cribriform ligament acts as a predisposing and causal factor. It will be recalled that this so-called ligament is merely a network of interlacing fibers, the continuation of the inner corneal fibers; they form the anterior boundary of the angle of the anterior chamber.

Priestly Smith, who has contributed so much to this subject, long ago emphasized the importance of the increased size of the lens due to its continued growth until late in life. As the result of this, the space between its margin and the adjacent structure—the so-called circumlental space—becomes much smaller. He has also pointed out that the changes in the lens from the same cause would tend to push the base of the iris forward against the posterior surface of the cornea. Some years ago Fischer expressed the belief that this disease was caused by an edema brought about by an acidosis affecting the tissue colloids. Alterations in the character of the aqueous as the result of changes in the ciliary body and the intraocular vessels have also been adequately considered. As aptly stated by de Schweinitz, no one theory can explain all cases of glaucoma, sometimes one factor and sometimes another is active in its production. Nettleship and Lawford have referred to a hereditary tendency that may be present and state that when this exists the disease may develop at an earlier age in succeeding generations.

Age has a definite relation and after forty there is a decided increase in its frequency; about eighty-five per cent. of the cases develop after this period. It is more frequently seen in women. It is more common among the Jews, and Elliot includes the natives of India with the Egyptians as also predisposed to it. Lack of proportion between the size of the lens and the globe is also a factor and Priestly Smith also

emphasized the importance of the small cornea in its relation to this condition. In those with acquired or inherited predisposition the instillation of mydriatics may set up an attack. Injuries and certain conditions such as influenza, neuralgia of the fifth nerve, herpes zoster and cardiac disease may act as exciting causes. Snellen was of the opinion that the overuse of ametropic eyes was also a factor. Finally, there are few surgeons who have not seen instances where sudden shocks, great anxiety or overwhelming emotions of one type or another have been the provocative cause of a glaucomatous attack.

ACUTE CONGESTIVE GLAUCOMA.

Usually this type of glaucoma is preceded by certain prodromal signs which may or may not have been severe enough to attract the serious attention of the patient. They are manifested by short periods of hazy vision, varying in its intensity and persisting from one to several hours; there may be some accompanying ocular or periorbital discomfort. When looking at distant lights it may be noted that these appear to be surrounded by a ring of prismatic colors, in which those corresponding to the short wave lengths, the violet or blue, are within, while red, representing the long waves, is without. Upon examination the pupil of the affected side may be found to be a trifle larger than its fellow and if condensed light be thrown upon the eye a faint haze of the cornea may be detected. A slight rise of the intra-ocular tension will be found by the use of the tonometer. Certain or all of these signs may recur at more or less frequent intervals for several months or more before the actual outburst of an acute attack. During this interval, owing to changes in the cornea or in the accommodation, the patients may desire changes in their glasses, especially for near work.

All too frequently physicians are not consulted during one of these prodromal periods and the patient is first seen after the outburst of a frank acute attack, which may be unilateral or bilateral. This is apt to occur sometime during the night and is ushered in by severe pain in the head and about the eye, at times so intense that nausea and vomiting may occur. A rapidly increasing failure of vision is now noted. At the

height of a severe attack examination would show more or less swelling of the lids, the conjunctival and episcleral vessels much injected and this may be associated with some chemosis. The cornea is distinctly hazy, and more or less anesthetic; the anterior chamber shallow; the pupil dilated, frequently oval and reacts to light but slightly, if at all. The iris may appear discolored. When tested by the finger tips, the intraocular tension will be found to be markedly increased. The tenderness of the globe and the swelling of the lids, if this be present, may make it difficult for untrained fingers to elicit this rise of tension despite the fact that it is quite marked. Owing to the haziness of the media no satisfactory study can be made of the fundus, but if this were possible no cupping of the disc would be found during the first attack. Even a rough test will reveal a contraction in the visual field, the nasal portion being more involved. Depending upon the severity of the outburst, these signs and symptoms gradually subside although to the trained examiner some evidences of the past attack usually can be detected by the distention of the episcleral vessels; the slightly dilated pupil, which is often oval and less responsive to light; some impairment in the field of vision and persistence of the tension, to a greater or less degree. In certain cases the return of vision is astonishingly satisfactory but as a rule some impairment persists.

The eye may remain in this condition for a variable period, but is liable to slight or severe exacerbations at any time. Each attack still further lessens the functional integrity of the globe. It is during this period that the characteristic fundus changes develop, such as the cupping or excavation of the head of the optic nerve, which is frequently surrounded by a narrow zone of choroidal atrophy; with this there may be pulsation of the retinal arteries. Should the acute attack develop in the course of a chronic or non-congestive type of glaucoma, these fundus manifestations may be present during the first acute outbreak although the clouded media would prevent their observation with the ophthalmoscope.

Sooner or later, if the progress of the disease continues, the stage of absolute glaucoma sets in, during which period degenerative changes in all the ocular structures develop. There is some injection of the globe, chiefly of the episcleral

vessels; the cornea is distinctly hazy and may exhibit various degenerative manifestations. The anterior chamber is shallow, the pupil dilated and fixed, the iris atrophic and apt to be plastered against the cornea at its periphery. The lens is cataractous and the tension is raised to the maximum. During this stage, the patient is apt to have attacks of pain, either dependent upon the primary process or upon degenerative corneal changes. As the condition persists evidences of staphylomata may appear owing to thinning of the sclera. Eventually, if the patient does not seek relief by having the eye enucleated, atrophy of the globe sets in as the result of marked destructive changes produced in the intraocular structures.

SUBACUTE CONGESTIVE GLAUCOMA.

This type of the disease may result from either of the other two types as stated above. In turn it may be accompanied by acute exacerbations. The symptoms are essentially the same as those enumerated above but of less intensity. If not checked it shows the same progressive tendencies.

CHRONIC NON-CONGESTIVE GLAUCOMA.

(Simple Glaucoma.)

This is invariably a bilateral manifestation although one eye may be affected before the other. As its name implies it is not associated with any external congestive signs such as accompanies the other forms, although slight overfilling and tortuosity of the episcleral vessels at times can be noted. As the border line between this and the subacute congestive type is not always sharply defined, a few observers have regarded this type as an optic atrophy with excavation.

The onset is gradual and so insidious that it may be present for months without attracting the patient's attention. Even in the presence of definite intraocular changes such eyes may show a clear cornea, anterior chamber of average depth and no iris or pupillary changes that could be regarded as characteristic. Finger tension may be normal and even the tonometric findings may be within normal limits at the time of coming under observation. On the other hand careful examination may detect a suspicious lack of corneal transparency,

and a rise of tension does occur although it may be periodic, and this applies to different times of the same day just as it may apply to different days.

As to the subjective symptoms, there is no pain and the patient may have standard vision. At times a history of temporarily disturbed vision may be obtained. If the condition has persisted for some time, the central vision may still remain unusually good, although at times associated with a certain amount of haziness, but there will be found definite changes in the peripheral vision. These changes usually affect the nasal field in the sense of a partial or complete loss, or more rarely, there may be a concentric contraction. With this small blind areas, or scotomata, are frequently present about the central part of the field, such as have been described by Bjerrum and Seidel; these are continuous with the physiologic blind spot. Rönne's sign or "step" may be found in certain instances.

Sooner or later the central vision becomes impaired, but at no time can it be safely used as an index to the progress of the disease. This fact should be thoroughly understood.

The definite diagnosis of this type is dependent upon the use of the ophthalmoscope. Here, in the absence of congestive signs, all the media are clear and from the onset the fundus structures can be readily seen, providing there are no associated anomalies to prevent. In a well established case there will be no difficulty in seeing the deep complete cup that extends to the margin of the nerve head, which in turn may be surrounded by the so-called halo. This cupping is associated with a sharp bending of the retinal vessels where they dip into or pass over the margin of the excavation. In certain instances pulsation of the retinal arteries can be seen.

Diagnosis. Owing to the progressively destructive character of this disease and the rapidity of its progress in certain acute cases, an early diagnosis is of the utmost importance. Glaucoma is not infrequently mistaken for certain other conditions where severe periorbital pain may occur, such as trigeminal neuralgia and ophthalmic migraine. The confusing of acute glaucoma and acute iritis leads to the most serious consequences and not infrequently to the ultimate loss of the eye. It is the differential diagnosis with which every general

practitioner should be familiar. Here the history of prodromal symptoms should be of service and the shallow chamber, dilated pupil and plus tension of glaucoma stands in contrast to the anterior chamber of normal depth, the contracted pupil and tendency to the formation of posterior synechiæ as seen in iritis. Almost as serious is the mistaking of a chronic glaucoma for cataract. Here a glance with the ophthalmoscope would prevent the gradually failing vision and greenish reflex from the lens being attributed to advancing cataractous changes. When in doubt as to the existence of glaucoma, the practitioner would do well to seek at once the best advice available. In certain cases the differentiation between optic atrophy and chronic glaucoma requires careful and painstaking investigation. The history, careful perimetric examinations, the use of the tonometer, and the study of the light sense are of value.

Almost invariably an operation is, sooner or later, the best treatment for glaucoma; as a consequence the patient should be seen by an ophthalmic surgeon as early as possible.

Treatment. If the condition is recognized in the prodromal period the use of pilocarpin hydrochlorate or eserine sulphate should be resorted to immediately and continued indefinitely.

Three conditions must be considered at once when confronted by an acute attack: First, the advisability of an immediate consultation with an ophthalmic surgeon, for acute glaucoma is to ophthalmology what acute appendicitis is to medicine. Second, the opening up of the anterior filtration channels of the eye. Third, the relief of pain. As to the first, the patient should be seen as soon as possible by an ophthalmic surgeon and the responsibility for the time and choice of operation should be placed in his hands. For the second, eserine, grains 2 to 4 to the ounce, should be used every hour until the pupil is well contracted. This opens up the filtration area in the angle of the anterior chamber and gives a greater expanse of spongy iris tissue; each contributes to better filtration of the aqueous. With the pupils contracted the frequency of the instillations may be reduced, for considerable brow pain is apt to follow the frequent instillations of these stronger solutions. A drop two or three times a day as an initial routine is inadequate. For the third condition, the

pain, the frequent use of hot fomentations will be of service, but the use of morphine is justifiable, for the pain is usually intense and in severity comparable to a renal or hepatic colic. Later, sodium salicylate in 15 to 20 grain doses three to four times a day will usually prove efficient. The condition is essentially a surgical one and the physician in general practice should not assume the responsibility for delay, if this can be avoided.

In the chronic, non-congestive type, certain cases do well for varying periods of time under the use of miotics. For this purpose weak solutions of pilocarpin or eserine should be used, but in sufficient strength to maintain miosis. With de Schweinitz, I believe pilocarpin is preferable at first, for it can be maintained over a longer period of time without producing conjunctival irritation. Eserine gr. $\frac{1}{10}$ to gr. $\frac{1}{6}$, or pilocarpin gr. $\frac{1}{4}$ to the ounce, may be a sufficient initial strength. This should be instilled three to four times a day, the last drop to be used before the patient goes to bed. Small quantities should be prescribed as fresh solutions are desirable.

Needless to say, many factors are to be considered when reliance is to be placed on miotics and in certain cases immediate operation is desirable. For this reason it may be said that all types of glaucoma should come under the earliest possible surgical surveillance and what is of almost equal importance, should remain so. While many underlying factors in this disease are still unknown, individuals affected should be regarded as sick patients rather than patients with sick eyes, and should be treated as such.

The discussion of operative treatment is not particularly pertinent, but I prefer iridectomy in acute glaucoma; while in the chronic type iridectomy and the Elliot trephining operation have been most frequently employed. In certain glaucomatous conditions cyclodialysis has been of service. Aside from the Elliot operation certain other filtering procedures have given satisfactory results, such as the operations of Fergus, Herbert, Lagrange and Holth. Harrower and others have obtained good results from iridotaxis.

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